



## **FEASIBILITY STUDY**

Former Pechiney Cast Plate, Inc. Facility

3200 Fruitland Avenue

Vernon, California

*Prepared for:*

**Pechiney Cast Plate, Inc.**

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This report was prepared by the staff of AMEC Environment & Infrastructure, Inc., under the supervision of the Engineer and/or Geologist whose signatures appear hereon.

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## ACRONYMS AND ABBREVIATIONS

|           |   |
|-----------|---|
| AF        | attenuation factor  |
| Alcoa     | Aluminum Company of America   |
| ALM       | Adult Lead Model  |
| AMEC      | AMEC Environment & Infrastructure, Inc. formerly AMEC Geomatrix, Inc. |
| ARAR      | applicable or relevant and appropriate requirement                    |
| ATSDR     | Agency for Toxic Substances and Disease Registry                      |
| BTEX      | benzene, toluene, ethylbenzene, and total xylenes                     |
| bgs       | below ground surface  |
| Cal-EPA   | California Environmental Protection Agency                            |
| Century   | Century Aluminum Company  |
| CERCLA    | Comprehensive Environmental Response, Compensation, and Liability Act |
| cfm       | cubic feet per minute   |
| cfu/gm-dw | bacteria colony forming units per gram of soil dry weight             |
| CFR       | Code of Federal Regulations   |
| CHHSL     | California Human Health Screening Level                               |
| COC       | chemical of concern   |
| COPC      | chemical of potential concern   |
| CPT/ROST  | cone penetration test/rapid optical screening test                    |
| Cr (VI)   | hexavalent chromium   |
| DAF20     | dilution attenuation factor of 20                                     |
| 1,2-DCA   | 1,2-dichloroethane  |
| 1,1-DCE   | 1,1-dichloroethene  |
| DPH       | Department of Public Health   |
| DTSC      | Department of Toxic Substances Control                                |
| DWR       | Department of Water Resources   |
| EDR       | Environmental Data Resource   |
| EPC       | exposure point concentration  |



|            |   |
|------------|---|
| ESA        | Environmental Site Assessment   |
| FS         | Feasibility Study   |
| Geomatrix  | Geomatrix Consultants, Inc.,  |
| GRA        | general response actions  |
| H&EC       | City of Vernon Health & Environmental Control                         |
| HHRA       | human health risk assessment  |
| HI         | hazard index  |
| HPWD       | City of Huntington Park Water Department                              |
| HQ         | hazard quotient   |
| MCL        | Maximum Contaminant Level   |
| MNA        | monitored natural attenuation   |
| µg/L       | micrograms per liter  |
| mg/kg      | milligrams per kilogram   |
| mg/kg/year | milligrams per kilogram per year                                      |
| NCP        | National Contingency Plan   |
| O&M        | operation and maintenance   |
| OEC        | other environmental condition   |
| OEHHA      | Office of Environmental Health Hazard Assessment                      |
| Order      | Imminent and Substantial Endangerment Determination and Consent Order |
| pg/g       | picograms per gram  |
| PCB        | polychlorinated biphenyl  |
| PCBNP      | Polychlorinated Biphenyl Notification Plan                            |
| PCE        | tetrachloroethene   |
| Pechiney   | Pechiney Cast Plate, Inc.   |
| PPE        | personal protective equipment   |
| PRG        | preliminary remediation goal  |
| RAO        | remedial action objective   |
| RAP        | Remedial Action Plan  |

|           |  |
|-----------|--|
| RBSL      | risk-based screening level   |
| REC       | recognized environmental condition   |
| RI/FS     | remedial investigation/feasibility study   |
| RWQCB     | California Regional Water Quality Control Board, Los Angeles Region                  |
| SAP       | Sampling and Analysis Plan   |
| SCAQMD    | South Coast Air Quality Management District  |
| SCM       | site conceptual model  |
| Site      | Former Pechiney Cast Plate, Inc. Facility, 3200 Fruitland Avenue, Vernon, California |
| SMP       | Soil Management Plan   |
| SSL       | soil screening level   |
| SVE       | soil vapor extraction  |
| SVOC      | semi-volatile organic compound   |
| TBC       | to-be-considered   |
| 1,1,1-TCA | 1,1,1-trichloroethane  |
| TCE       | trichloroethene  |
| TEQ       | toxic equivalent   |
| TEF       | toxic equivalent factor  |
| TEPH      | total extractable petroleum hydrocarbons   |
| TMB       | trimethylbenzene   |
| TPH       | total petroleum hydrocarbons   |
| TPHCWG    | Total Petroleum Hydrocarbon Criteria Working Group                                   |
| TRPH      | total recoverable petroleum hydrocarbons   |
| TSCA      | Toxic Substances Control Act   |
| TVPH      | total volatile petroleum hydrocarbons  |
| URS       | URS Corporation  |
| U.S. EPA  | United States Environmental Protection Agency  |
| USGS      | United States Geological Survey  |
| UST       | underground storage tank   |

|                 |  |
|-----------------|--|
| Vernon Facility | former Pechiney Cast Plate, Inc. facility, 3200 Fruitland Avenue, Vernon, California |
| VOC             | volatile organic compound  |
| VWD             | City of Vernon Water Department  |
| WHO             | World Health Organization  |

**FEASIBILITY STUDY**  
Former Pechiney Cast Plate, Inc. Facility  
3200 Fruitland Avenue  
Vernon, California

## **1.0 INTRODUCTION**

AMEC Environment & Infrastructure, Inc. (formerly AMEC Geomatrix, Inc. [AMEC]), has prepared this Feasibility Study (FS) on behalf of Pechiney Cast Plate, Inc. (Pechiney), for the former Pechiney facility (Vernon Facility or Site) located at 3200 Fruitland Avenue in Vernon, California (Figure 1). This FS evaluates potentially applicable remedial technologies and provides recommendations for the proposed, preferred remedy for impacted soil and soil vapor within the vadose zone, impacted groundwater, and impacted concrete at the Site using the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Remedial Investigation/Feasibility Study (RI/FS) guidance (United States Environmental Protection Agency [U.S. EPA], 1988). In addition, an evaluation of the potential for continued or future impacts to groundwater quality from soil impacts in the vadose zone is presented in this FS.

Based on the proposed preferred remedies discussed in this FS, a Remedial Action Plan (RAP) (AMEC, 2012) has been prepared to mitigate chemicals of concern (COCs; including metals) in the vadose zone that exceed proposed site-specific remediation goals. Implementation details for the proposed, preferred alternatives are discussed in the RAP. Upon finalization of the FS, the RAP is to be implemented 1) pursuant to the Department of Toxic Substances Control (DTSC) Imminent and Substantial Endangerment Determination and Consent Order between the DTSC and Pechiney (Order; DTSC, 2010), 2) pursuant to the City of Vernon Health and Environmental Control (H&EC; also referred to as the City of Vernon Environmental Health Department) existing orders/directives, and 3) pursuant to the directive/order from any other necessary public agency including U.S. EPA with respect to the polychlorinated biphenyls (PCB)-impacted concrete and soil at the Site. The RAP discusses remedial alternatives for soil and soil vapor impacted with volatile organic compounds (VOCs) and petroleum hydrocarbons (including Stoddard solvent compounds); soil impacted with metals (specifically, arsenic) and PCBs; groundwater impacted with VOCs; and demolition and disposal of concrete impacted with PCBs. On July 6, 2010, DTSC issued the Order, and DTSC has approval authority for implementation of the proposed site-wide RAP. Pursuant to Code of Federal Regulations (CFR), Title 40, Subchapter R, Toxic Substances Control Act (TSCA), Part 761 (40 CFR 761) including applicable amendments (June 29, 1998, 40 CFR Parts 750 and 761), U.S. EPA has approval authority for risk-based remediation of PCB

releases and disposal of PCB-remediation waste (soil and concrete). Pursuant to TSCA, a risk-based application referred to as the Polychlorinated Biphenyls Notification Plan (PCBNP; AMEC, 2009) was submitted to U.S. EPA on July 13, 2009. On July 2, 2010, U.S. EPA issued a conditional approval letter regarding the PCBNP, which outlined requirements for additional PCB sampling and submission of additional information. In the conditional approval letter, U.S. EPA also deferred the approval of the PCB remediation goals until the additional PCB sampling results and information was submitted to U.S. EPA for review. The results of the additional sampling were submitted to U.S. EPA on December 29, 2010. U.S. EPA's conditional approval of the PCB remediation goals was granted on July 1, 2011. This FS was revised to address additional comments made by DTSC to the September 2009 draft FS, and additional requirements imposed by U.S. EPA.

Remedial alternatives similar to those proposed in this FS would be applied to any shallow impacted soil or concrete discovered during the below-grade demolition work.

The FS has been prepared using 40 CFR 300, also known as the National Contingency Plan (NCP; U.S. EPA, 1990), and other guidance documents developed by the U.S. EPA. Under the NCP 40 CFR 300.430(d)(1), potential future exposure scenarios are used to develop site-specific, risk-based remediation goals. For this Site, several exposure scenarios were evaluated, including potential exposures related to future construction and future commercial/industrial use at the Site.

This FS includes the following information (listed by relevant section).

- Section 2.0 provides a Site description and history along with the geologic and hydrologic settings.
- Section 3.0 summarizes the scope and findings of previous remedial investigations and discusses the nature and extent of known impacted areas.
- Section 4.0 presents the Site Conceptual Model (SCM) and the results of a screening-level human health risk assessment (HHRA).
- Section 5.0 introduces the remedial action objectives (RAOs) for the Site; proposed remediation goals; summarizes areas of known impacts; and presents the general response actions (GRAs), that when implemented, will meet the RAOs for the Site.
- Section 6.0 discusses the screening criteria and evaluation process used for selection of potential remedial alternatives.
- Section 7.0 provides a detailed evaluation of the remedial options identified during the screening process.
- Section 8.0 presents the proposed, preferred remedial alternatives for the Site.

- Section 9.0 discusses the community involvement process.
- Section 10.0 provides a list of references used to prepare the FS.

## **2.0 BACKGROUND**

This section summarizes the Site description and history and the geologic and hydrogeologic setting.

### **2.1 SITE DESCRIPTION AND HISTORY**

The Site was once part of a 56-acre, aluminum manufacturing facility owned and operated by Aluminum Company of America (Alcoa). The historical and current Site plans of the former Alcoa facility are shown on Figures 2 and 3, respectively.

Alcoa's manufacturing operations at the Site reportedly began in approximately 1937. Previous manufacturing at the Site included production of high-precision cast aluminum plates. As part of their manufacturing operations, Alcoa used fuels and Stoddard solvent, both of which were stored in underground storage tanks (USTs). Alcoa used Stoddard solvent as part of the aluminum manufacturing process. Alcoa also operated processes that required lubricating and hydraulic oils and generated hazardous waste that was stored at various locations throughout the Site. In approximately 1997, Alcoa sold the eastern half of the facility, which subsequently was razed, subdivided, and redeveloped for industrial and commercial uses. In December 1998, Alcoa sold the western portion of the facility (3200 Fruitland Avenue) to Century Aluminum Company (Century). In 1999, Pechiney purchased the Site from Century. At that time, Alcoa investigated subsurface conditions and conducted limited remediation in both the eastern and western portions of the facility as part of their efforts to seek the closure of its City of Vernon H&EC hazardous materials permit.

The Site is comprised of approximately 26.9 acres (including Assessor Parcel Numbers 6301-008-010, -011, -012, -013, which was divided into Parcels 6, 7, and 8; Figure 3) and was formerly occupied by approximately 600,000 square feet of building area. As part of the aboveground demolition work completed in November 2006 at the Site, the above-ground features, including the former manufacturing facilities, were demolished, and the debris was transported off-site for disposal or recycling.

The procedures for the remaining demolition work related to the removal of building slabs, pavements, below-grade man-made structures (including footings, foundation, pits, and sumps), and other structures located adjacent to the former building areas are described in the initial Below Grade Demolition Plan (AMEC, 2011). This FS evaluates the details and procedures for remediating impacted concrete and soil during below-grade demolition, and soil vapor during and after below-grade demolition.

## **2.2 LAND USE**

The Site is zoned for industrial use. The City of Vernon zoning regulations prohibit development of new residential properties within the City. A land use covenant is proposed to be issued by Pechiney, with concurrence from the City of Vernon, to restrict future Site use (i.e., prohibit residential development) and use of groundwater from the first water-bearing unit within the Site perimeter.

The City of Vernon is in the process of purchasing the property. The future Site use will remain industrial or commercial. The City of Vernon considered using a portion of the property for a power plant. However, on September 28, 2009, the City of Vernon withdrew its certification application for the Southeast Regional Energy Project (Docket 06-AFC-04) and indicated that a new application for certification of a smaller power plant would be considered. On October 1, 2009, the California Energy Commission approved the termination of the application for certification.

## **2.3 GEOLOGIC AND HYDROGEOLOGIC SETTING**

The physical setting of the Site, including Site topography, surface water, geology, and hydrogeology, is discussed in the following subsections.

### **2.3.1 Topography and Surface Water**

Topography in the Site vicinity is shown on the United States Geological Survey (USGS) South Gate, California 7.5-minute series Topographic Quadrangle Map (1964, photorevised 1981). The Site is located in Township 2 South, Range 13 West, Section 14, San Bernardino Base & Meridian at approximately 180 feet above mean sea level. The local topographic gradient is gentle, sloping toward the south at approximately 25 feet per mile. The Los Angeles River, the surface water body nearest to the Vernon Facility, is located approximately 4000 feet north-northeast of the Site.

### **2.3.2 Geology and Hydrogeology**

Information presented in this section is based on the State of California Department of Water Resources (DWR) Bulletin 104 (DWR, 1961), or as referenced below.

#### **2.3.2.1 Geology**

Sediments underlying the Site and its vicinity are associated with Recent Alluvium, the Lakewood Formation, and the underlying San Pedro Formation. Based on basin-scale interpretations presented in DWR (1961), Recent Alluvium extends from ground surface to a depth of approximately 100 feet and consists primarily of stream-deposited gravel, sand, silt, and clay with some interbedded marine deposits. The Recent Alluvium is underlain by approximately 150 to 200 feet of the Upper Pleistocene Lakewood Formation, which consists

of alternating sequences of fine- and coarse-grained alluvial sediments. The Lakewood Formation is underlain by the Lower Pleistocene San Pedro Formation which consists of approximately 900 to 1200 feet of sand and gravel, interbedded with clays of marine origin.

Based on the documents reviewed by Geomatrix Consultants, Inc. (Geomatrix), previous investigations conducted at the former Alcoa facility (including the portion of the facility that comprise the Site) suggest the Site is underlain by fine-grained (predominantly silt) and coarse-grained (predominantly sand) sediments (referred to by others as Recent Alluvium) from ground surface to approximately 40 feet below ground surface (bgs) (Geraghty & Miller, 1991). Sediments below 40 feet are predominantly silt and clay (referred to by others as the Bellflower aquitard) from approximately 40 to 85 feet bgs, and predominantly sand (referred to by others as the Lakewood Formation) to a depth of at least 161.5 feet, the total depth of the deepest soil boring drilled at the Site (Geraghty & Miller, 1991). Although observed at different depths, similar lithology was encountered by Geomatrix during its investigations at the Site. Cross-sections depicting the lithology at the Site are shown on Figures 4 and 5.

#### **2.3.2.2 Hydrogeology**

The Site is located within the Los Angeles Forebay Area of the Central Basin of the Los Angeles County Coastal Plain. The Central Basin is bounded on the northwest by the Santa Monica Mountains; on the north and northeast by the Repetto, Merced, and Puente Hills; on the east by Coyote Creek (the approximate Orange County/Los Angeles County line); and on the south and west by the Pacific Ocean. The Central Basin is largely composed of alluvial sediments shed from the surrounding hills and mountains (DWR, 1961).

Aquifers between ground surface and a depth of approximately 700 feet bgs at the Site include the Exposition, Gage, Hollydale, Jefferson, and Lynwood aquifers. The Exposition and Gage aquifers are part of the Lakewood Formation, while the Hollydale, Jefferson, and Lynwood aquifers are part of the underlying San Pedro formation. Below the Lynwood aquifer are the Silverado and Sunnyside aquifers of the San Pedro formation. These aquifers have variable thicknesses and are separated by undifferentiated finer-grained sediments. Perched groundwater may be associated with the Bellflower aquiclude in the Recent Alluvium (DWR, 1961).

Historical boring logs indicate shallowest groundwater beneath the Site was encountered within a sand unit, interpreted to be the Exposition aquifer within the Lakewood Formation, between depths of 145 and 150 feet bgs (Geraghty & Miller, 1991 and 1995). Groundwater was encountered by Geomatrix at a depth of approximately 150 feet in soil borings advanced in the northern portion of the Site (Geomatrix, 2006b and 2006c). Boring logs reviewed by Geomatrix did not indicate the presence of perched groundwater above and within sediments



interpreted as the Bellflower aquiclude. Perched groundwater was not observed during Geomatrix's Site investigations (Geomatrix, 2006b and 2006c).

The California Regional Water Quality Control Board, Los Angeles Region (RWQCB) Basin Plan (RWQCB, 1994) designates groundwater in the Site vicinity for beneficial use. According to information provided by the City of Vernon H&EC, groundwater is produced off-site from the Jefferson, Lynwood, Silverado, and Sunnyside aquifers from depths of approximately 450 to 1400 feet bgs (based on wells No. 15 and 19; Geoscience, 2005).

Additional information regarding water supply wells in the vicinity of the Site was presented in the Phase I Environmental Site Assessment (ESA) report (Geomatrix, 2005a). In summary, 15 municipal water supply wells, 9 USGS monitoring wells, and 1 well listed by the Environmental Data Resource (EDR) Aquiflow Database were identified within a 1-mile radius of the Site (EDR, 2005). Seven wells belong to the City of Vernon Water Department (VWD) and four wells belong to the City of Huntington Park Water Department (HPWD). The remaining 10 wells did not have ownership listed in the EDR report.

Of the 15 designated municipal wells, 2 VWD municipal well clusters are located within a 1-mile radius of the Site and consist of 6 active wells (VWD well numbers 11, 12, 15, 16, 17, and 19); 2 inactive wells (VWD well numbers 5 and 7); and 3 destroyed wells (VWD well numbers 9, 10, and 13). In addition, one well cluster is located approximately ½-mile northwest of the Site and the other well cluster is located approximately ⅓-mile northeast of the Site.

HPWD municipal wells located within a 1-mile radius of the Site consist of two active wells (HPWD well numbers 14 and 17); one inactive well (HPWD well number 9); and one destroyed well (HPWD well number 11). One active well is located approximately ½-mile southwest of the Site, and the other active well is located approximately 1-mile southeast of the Site.

In preparation of Alcoa seeking environmental closure of its facility, nine groundwater monitoring wells were constructed by Alcoa between 1990 and 1991 under the oversight of the City of Vernon H&EC. Six of these monitoring wells, AOW-1, AOW-3, AOW-6, AOW-7, AOW-8, and AOW-9, were located on the Site and the other three wells were located on the eastern portion of the Alcoa facility that was previously sold and redeveloped (Figure 2). According to documents reviewed (A.J. Ursic, Jr., 1999a; Enviro-Wise, 1998; and Alcoa, 1997), all but three of these monitoring wells (AOW-6, AOW-8, and AOW-9) were destroyed by Alcoa under the oversight of the City of Vernon H&EC. The three remaining groundwater monitoring wells are located near former Building 112A in the southern portion of Parcel 7. Groundwater monitoring conducted between 1990 and 1997 indicates that the depth to groundwater beneath the Site during that time ranged from approximately 135 to 158 feet bgs

(Enviro-Wise, 1998). Reported groundwater depth measurements ranged from 136.24 to 140.40 feet below top of well casing in wells AOW-6 and AOW-8, respectively (URS Corporation [URS], 2006). Groundwater monitoring data are provided in Appendix A. Groundwater flow direction was reported as west-northwesterly (Geraghty & Miller, 1991 and 1995; Enviro-Wise, 1998; and URS, 2006). In addition, the groundwater flow direction was reported to the west-northwest for other properties in the Site vicinity (Environmental Audit, Inc., 2009). Regional groundwater flow in the vicinity of Vernon is to the west as depicted on a 2001 groundwater elevation contour map (Water Replenishment District of Southern California, website located at <http://www.wrd.org>).

### **3.0 SITE CHARACTERIZATION**

This section discusses investigations and assessments, including previous remediation activities, conducted at the Site. Sampling data collected from previous investigations conducted at the Site are summarized in Appendix A, and sample locations are shown on Figure 6.

#### **3.1 ALCOA'S PREVIOUS INVESTIGATIONS**

Previous investigations were conducted by consultants to Alcoa and were related to closure of Alcoa's facilities and operations on and east of the Site (including Alcoa's efforts to seek closure of its City of Vernon H&EC hazardous materials permit). These investigations were conducted under the oversight of the City of Vernon H&EC. Previous investigations included the collection and analysis of soil, groundwater, soil vapor, and building materials samples. A summary of previous Alcoa investigations is presented in the Phase I ESA (Geomatrix, 2005a). During these investigations, soil impacted with petroleum hydrocarbons (including Stoddard solvent), metals, PCBs, and VOCs were identified. The presence of chlorinated VOCs also was identified in groundwater at a depth of approximately 150 feet bgs within the southwestern portion of Parcel 7, west of Building 112A. In addition, limited soil remediation was conducted in discrete areas of the Site by Alcoa as discussed in Section 3.2.

In 1999, the City of Vernon H&EC issued a letter approving these remedial actions with specific provisions that include the following.

- Stoddard solvent impacts to soil would be addressed by Alcoa.
- Future review and determinations may be necessary if subsequent information, which significantly affects any decision, is found regarding the Site.

In a subsequent letter dated July 18, 2006, the City of Vernon H&EC required that Alcoa provide a plan by August 30, 2006 for active remediation of the Stoddard solvent-impacted soil (City of Vernon, 2006). The requirements for active remediation were based on the most

recent soil data indicating that Stoddard solvent contamination exceeded cleanup standards and that the overlying buildings and foundations, which limited the physical removal of the impacted soil, would be removed. According to the City of Vernon H&EC, Alcoa did not submit the required plan.

As part of Alcoa's preparation for seeking closure of its facility, groundwater wells were installed at the Site in 1990 by Alcoa under the oversight of the City of Vernon H&EC as discussed in Section 2.3.2.2. The locations of the monitoring wells are shown on Figure 2. Groundwater quality data collected from monitoring wells sampled and analyzed between 1990 and 1997 indicated the presence of trichloroethene (TCE); 1,2-dichloroethane (1,2-DCA); and chloroform in the upper portion of the Exposition aquifer (first water-bearing unit) in groundwater beneath the southwest portion of the Site with historical concentrations of 160 micrograms per liter ( $\mu\text{g/L}$ ), 370  $\mu\text{g/L}$ , and 105  $\mu\text{g/L}$ , respectively, of TCE, 1,2-DCA and chloroform (Enviro-Wise, 1998). The highest concentrations of these VOCs were detected in groundwater in the vicinity of the former Stoddard solvent USTs located outside of Building 112A in Parcel 7. Although groundwater was impacted with TCE, 1,2-DCA and chloroform, these chemicals were not detected in soil in the vicinity of the Stoddard solvent USTs (historical soil data are provided in Appendix A).

Previous evaluations conducted by Alcoa suggested the source of VOCs in groundwater in the southwest portion of Parcel 7 was from an upgradient, off-site source. At the time, the City of Vernon H&EC concurred with this evaluation, but because the closure of the groundwater wells would require RWQCB concurrence and approval, Alcoa submitted its recommendations for Site closure to the RWQCB on February 18, 1999 (Alcoa, 1999). Because groundwater at these wells was impacted by chlorinated VOCs and because the wells were located in an area associated with the former Stoddard solvent USTs, the RWQCB required that Alcoa perform additional analysis of groundwater for methyl tertiary-butyl ether and fuel oxygenates (RWQCB, 2002). Alcoa conducted additional monitoring of the remaining three groundwater wells in 2005 and 2006 and submitted the monitoring data to the RWQCB. Based on the monitoring results, the concentrations of chlorinated VOCs decreased relative to the concentrations reported earlier (1990-1997). The compounds TCE, 1,2-DCA, and chloroform were detected at concentrations up to 28  $\mu\text{g/L}$ , 6.1  $\mu\text{g/L}$ , and 8.6  $\mu\text{g/L}$ , respectively, during the 2006 sampling event (URS, 2006). These compounds were not detected in groundwater samples collected from well AOW-6.

In a March 28, 2008 letter, the RWQCB directed Alcoa to 1) provide a work plan to characterize residual soil contamination in the former Stoddard solvent UST area and submit a site-specific health and safety plan by April 25, 2008; 2) sample the groundwater wells in the former UST area (AOW-7, AOW-8 and AOW-9) or install and sample replacement

groundwater wells if AOW-7, AOW-8 and AOW-9 cannot be used or located; 3) submit additional historical reports and data related to the Stoddard solvent releases; 4) analyze soil and groundwater for a specific suite of petroleum hydrocarbon compounds and VOCs; 5) log and sample soil at 5-foot intervals, at lithologic changes, or observed impacted soil; and 6) initiate electronic submittals through the State database (RWQCB, 2008a).

In December 2008, the RWQCB (2008b) determined that the impacts associated with chlorinated solvents in soil and groundwater at the Site, including the area of the former Stoddard solvent USTs, should be addressed under the jurisdiction of the DTSC. Although the Stoddard solvent impacts remain the responsibility of Alcoa, as directed by the September 2, 1999 and the July 18, 2006 letters from the City of Vernon H&EC, and a January 16, 2009 letter from the RWQCB, Alcoa has not taken responsibility for these impacts. On January 18, 2009, the RWQCB confirmed completion of Alcoa's site investigation and corrective actions to address soil impacts related to eight former USTs (containing gasoline diesel/No. 2 fuel oil and waste oil). The RWQCB specially excluded however, "subsequent investigations and/or remediation of the residual contamination associated with chlorinated solvents in soil and groundwater for the entire site, including the area [formerly] containing four Stoddard solvent USTs." In addition, RWQCB closure documentation specifically excluded the closure of the four Stoddard solvent USTs (referred to as USTs T-9 through T-12). The RWQCB deferred these remaining issues to the DTSC's oversight. Pursuant to the DTSC Order and the above actions, the Stoddard solvent-impacts and associated residual petroleum hydrocarbon-impacts have been included in this FS.

### **3.2 ALCOA'S PREVIOUS REMEDIATION ACTIVITIES**

Consultants to Alcoa have previously conducted remediation activities in specific areas of the Site under the direction of the City of Vernon H&EC. These remediation activities are briefly described below and the locations are shown on Figure 6.

- July to October 1992 – excavation of diesel fuel-impacted soil in conjunction with removal of three 10,000-gallon diesel USTs and a pump vault located south of electrical substation #2. The excavations were backfilled with engineered fill, compacted, and capped with concrete (OHM Remediation Services Corporation, 1992).
- January 1995 – removal of four 10,000-gallon Stoddard solvent USTs located west of Building 112A. The maximum excavation depth was 18 feet bgs. The area was backfilled with Stoddard solvent-impacted soil from 3 to 18 feet bgs. At that time, the City of Vernon H&EC "agreed that Alcoa could place the contaminated soil back into the excavation, provided that Alcoa would remediate the Site within a reasonable time frame" (CCG Group, Inc., 1995). A 6-mil plastic liner was placed over the Stoddard solvent-impacted soil, and clean soil was backfilled over the liner from 3 feet bgs to grade. The area was then capped with concrete.

Following the removal of the Stoddard solvent USTs and delivery system in January 1995, Alcoa conducted a soil investigation to evaluate the extent of the Stoddard solvent impacts (Morrison Knudsen Corporation, 1995). A number of investigations were performed by Alcoa between 1995 and 2005 (Environmental Protection and Compliance, 2006), and these investigations are described below.

- September through October 1995 – Alcoa conducted an initial soil investigation to evaluate the extent of Stoddard solvent-related soil impacts beneath Building 112A and west of the building near the former Stoddard solvent USTs (Morrison Knudsen Corporation, 1995). The areas investigated included the former tube mill and roll stretcher machine area (Area “A” borings), the former tube mill Stoddard solvent dip tanks and vault (Area “B” borings), the scalper planar machine and Stoddard feed line area (Area “C” borings), and the Stoddard solvent still house and UST area (Area “D” borings). Soil borings were advanced to depths between 45 to 67.5 feet bgs and cone penetration test/rapid optical screening test (CPT/ROST) borings were advanced to depths between 34 and 80.7 feet bgs. Petroleum hydrocarbon analyses included quantification of total volatile petroleum hydrocarbons (TVPH; carbon-chain range of c6 – c10) and total extractable hydrocarbons (TEPH; carbon chain range of c10 – c28). The soil TVPH concentrations ranged between 1.1 milligram per kilogram (mg/kg) to 76,000 mg/kg and TEPH concentrations ranged between 5.4 mg/kg to 53,000 mg/kg. The highest concentrations of these compounds were detected in Area B at depths between 46.5 and 50 feet bgs. Several soil samples also were tested for benzene, toluene, ethylbenzene, and total xylenes (BTEX) compounds, and these compounds were detected in soil. Based on AMEC’s review of the soil sample analytical results and qualitative petroleum hydrocarbon measurements obtained by CPT/ROST methods, the extent of these soil-impacts was assessed with the exception of two areas. The vertical extent of petroleum hydrocarbon-impacted soil was not completely assessed in Areas B and D. The approximate lateral extent of the Stoddard solvent-related soil impacts are shown on Figure 6 and the historical analytical soil results are included in Appendix A.
- August to November 1995 – Alcoa completed laboratory bench-scale treatability testing on Stoddard solvent-impacted soils obtained from the subsurface in the vicinity of former solvent handling and storage areas within Building 112A. The testing was conducted to determine the applicability of in situ bioremediation of vadose zone soils. The treatability testing included the use bioslurry reactor vessels and soil column reactors (Alcoa Technical Center, 1996a).

Analytical testing indicated that appropriate environmental conditions (including pH, naturally occurring nutrients, indigenous microbial populations, and soil moisture) existed to depths of 45 feet bgs that would be supportive of in situ biodegradation of Stoddard solvent-impacted soil. The primary findings associated with the bioslurry reactor testing indicated that under optimal test conditions, 50 percent of the hydrocarbons were degraded within four weeks under aerobic conditions within the reactor, and that less than 5 percent of the hydrocarbons were lost due to volatilization.



The primary findings from column reactor studies further supported that Stoddard solvent-impacted soils were amenable to biodegradation as hydrocarbon concentrations were reduced by 93 to 95 percent using a combination of biodegradation (80 percent) and volatilization (13 to 14 percent). Furthermore, significantly high levels of heterotrophic bacteria ( $10^8$  to  $10^9$  colony forming units per gram of soil dry weight [cfu/gm-dw soil]) and hydrocarbon degraders ( $10^5$  to  $10^6$  cfu/gm-dw soil) were found to be present within the soil (Alcoa Technical Center, 1996a). The results indicated that the addition of moisture and nutrients did not significantly alter degradation rates of the hydrocarbons.

- In 1995, on behalf of Alcoa, Morrison Knudsen Corporation and Groundwater Technology performed field trial tests to evaluate the applicability of soil vapor extraction (SVE) and bioventing technologies as remedial alternatives to mitigate the Stoddard solvent-impacted soils at the Site. Test procedures consisted of both vapor extraction and air injection with monitoring for oxygen, carbon dioxide, and soil gas. The report concluded that both technologies were viable and could be implemented if desired to remediate the Stoddard solvent-impacted soils (Alcoa Technical Center, 1996a).
- In 1996, Alcoa generated additional field respirometry testing data suggesting that naturally-occurring aerobic and anaerobic intrinsic bioremediation was on-going at the Site. The data indicated that natural aerobic degradation was occurring due to available molecular oxygen at rates of 200 to 400 milligrams per kilogram per year (mg/kg/year). The data also indicated that much slower degradation rates of 7 mg/kg/year were occurring through anaerobic biodegradation. The report indicated that Alcoa proposed intrinsic bioremediation (also referred to as monitored natural attenuation) as the passive full-scale remediation approach for Stoddard solvent-impacted soils (Alcoa Technical Center, 1996b).
- September and October 2005 - Alcoa conducted additional soil testing in 2005 to monitor the progress of the natural degradation of Stoddard solvent-related soil impacts in soil boring areas A, B, C and D (Environmental Protection and Compliance, 2006). AMEC compared the soil data collected in 2005 by Environmental Protection and Compliance to the soil data collected in 1995 by Morrison Knudsen Corporation to evaluate petroleum hydrocarbon concentration changes over time. The findings of this comparison are summarized below.

| Area | Findings   |
|------|--|
| A    | <ul style="list-style-type: none"> <li>• TVPH and TEPH concentrations decreased over time.</li> <li>• Remaining TVPH and TEPH maximum concentrations reported in 2005 were at 6080 mg/kg and 6200 mg/kg, respectively.</li> <li>• Concentrations greater than 1000 mg/kg remain at depths of 30 and 40 feet.</li> <li>• Vertical extent of soil impacts was assessed to 60 feet.</li> </ul>  |
| B    | <ul style="list-style-type: none"> <li>• TVPH and TEPH concentrations increased over time at several depth intervals.</li> <li>• Remaining TVPH and TEPH maximum concentrations reported in 2005 were at 41,600 mg/kg and 60,600 mg/kg, respectively (at a depth of 45 feet in boring B-1).</li> <li>• Concentrations greater than 10,000 mg/kg remain at depths of 45 and 50 feet.</li> <li>• Vertical extent was not assessed; total petroleum hydrocarbon (TPH)-impacted soil was detected to a depth of 50 feet.</li> </ul>  |
| C    | <ul style="list-style-type: none"> <li>• TVPH and TEPH concentrations decreased over time.</li> <li>• Remaining TVPH and TEPH maximum concentrations reported in 2005 were at 2220 mg/kg and 2500 mg/kg, respectively.</li> <li>• TVPH concentrations greater than 1000 mg/kg remain at a depth of 15 feet and TEPH concentrations greater than 1000 mg/kg remain at a depth of 45 feet.</li> <li>• Vertical extent of soil impacts was assessed to 65 feet.</li> </ul>  |
| D    | <ul style="list-style-type: none"> <li>• TVPH and TEPH concentrations increased over time at several depth intervals.</li> <li>• Remaining TVPH and TEPH maximum concentrations reported in 2005 were at 6020 mg/kg and 10,800 mg/kg (at 45 feet at boring D-2).</li> <li>• TVPH and TEPH concentrations greater than 1000 mg/kg remain at depths of 15, 43, and 44.5 feet and TEPH concentrations greater than 10,000 mg/kg remain at a depth of 45 feet.</li> <li>• Vertical extent was not assessed; TPH impacted soil was detected to a depth of 45 feet.</li> </ul> |

- Based on the soil investigations and treatability testing described in a report prepared by Environmental Protection and Compliance in 2006, Alcoa recommended to the City of Vernon H&EC that long-term natural attenuation of the Stoddard solvent-impacted soils beneath Building 112A be allowed to continue as a passive remedy (Alcoa Technical Center, 1996c). The City of Vernon H&EC replied that the remaining Stoddard solvent contamination still exceeded cleanup standards and required Alcoa to submit a plan by August 31, 2006 for active remediation of this area (City of Vernon H&EC, 2006). Alcoa has not submitted its active remediation plan and has not performed any additional monitoring or active remediation work in this area. Alcoa's refusal to submit an active remediation plan is documented in an August 30, 2006 letter that Alcoa submitted to the City of Vernon H&EC (Alcoa, 2006).

- April 1998 – excavation of TPH-impacted soil in conjunction with removal of the Stoddard solvent Tube Mill dip tank located in Building 112A. The maximum excavation depth was 15 feet bgs. The area was backfilled with pea gravel and capped with concrete (A.J. Ursic, Jr., 1999a).
- June 1998 – excavation of TPH-impacted soil in conjunction with the removal of a sump from the 3-inch tube reducer foundation located in Building 112A. The maximum excavation depth was 5 feet bgs. The area was backfilled with native soil and capped with concrete (A.J. Ursic Jr., 1999a).
- October 1998 – excavation of refractory and asbestos-containing materials found in soil in conjunction with the construction of a sanitary pipeline located east of Building 112A. The maximum excavation depth was 4 feet bgs. The area was backfilled with road base and capped with asphalt (A.J. Ursic Jr., 1999a).
- December 1998 – excavation of PCB- and TPH-impacted soil in conjunction with the removal of an inert-waste disposal pit located west of Building 112A and south of the cooling tower. The maximum excavation depth was 45 feet bgs. Soil removal was terminated due to the proximity of the railroad tracks along the south and west sides of the excavation. The area was backfilled with soil and road base and capped with concrete (A.J. Ursic Jr., 1999a).
- January 1999 – excavation of PCB-impacted soil near storm water outfall #7 located west of Building 104. The maximum excavation depth was 6 feet bgs. The area excavated was limited by the presence of the adjacent sidewalk, building structures, and railroad tracks. The area was backfilled and capped with road base (A.J. Ursic Jr., 1999b).
- April 1999 – excavation of PCB-impacted soil at the discharge point of storm water outfall #6 located southwest of the cooling tower. The maximum excavation depth was 2 feet bgs. The area was backfilled and capped with road base (A.J. Ursic Jr., 1999a).
- April 1999 – excavation of PCB-impacted soil adjacent to the hot well along the north side of the cooling tower. The maximum excavation depth was 3 feet bgs. The area was backfilled and capped with road base (A.J. Ursic Jr., 1999a).
- May 1999 – excavation of PCB-impacted soil in conjunction with removal of a former condenser pad located outside the northwest corner of Building 106. The maximum excavation depth was 2 feet bgs. The area was backfilled with native soil and capped with concrete (A.J. Ursic Jr., 1999b).
- May 1999 – excavation of lead-impacted soil from a former ceramic disposal pit located beneath Building 135 on Parcel 6. The maximum excavation depth was 2 feet bgs. The area was backfilled with native soil and capped with asphalt (A.J. Ursic Jr., 1999c).
- June 1999 – excavation of PCB-impacted soil in conjunction with the removal of a French drain in Press Pit #2 located in Building 106. The maximum excavation



depth was 7 feet bgs. The area was backfilled and capped with concrete (A.J. Ursic Jr., 1999b).

The areas where previous remediation occurred as described above, including approximate horizontal limits of the excavation, excavation depth, and concentrations of remaining chemicals of potential concern (COPCs), are shown on Figure 6. As discussed in Section 3.1, the City of Vernon H&EC issued a closure letter to Alcoa in 1999 with the stipulation that Alcoa would continue to maintain responsibility for the Stoddard solvent-impacted soil. The letter also stated that further review or determinations may be necessary if new information related to environmental conditions at the Site is found (City of Vernon H&EC, 1999).

### **3.3 GEOMATRIX INVESTIGATIONS**

In June 2005, Geomatrix conducted a Phase I ESA (Geomatrix, 2005a) at the Vernon Facility to identify Recognized Environmental Conditions (RECs) as defined by ASTM International, Inc. E1527-00 for Phase I ESAs. In addition to identifying RECs, Geomatrix identified historical RECs and the potential of other environmental conditions (OECs) at the Site. The Phase I ESA report was submitted to the City of Vernon on September 1, 2005, and the City of Vernon H&EC concurred with the findings in their letter dated September 26, 2005. The findings of the Phase I ESA indicated the need for additional subsurface investigation work at the Site. Geomatrix submitted a Phase II ESA work plan (Geomatrix, 2005b) to the City of Vernon H&EC on September 2, 2005, and the work plan was approved by the City of Vernon H&EC on September 26, 2005 (City of Vernon H&EC, 2005). A summary of the Geomatrix investigations is described in the following subsections.

#### **3.3.1 Phase II Investigation**

Based on the findings of the previous investigations and the manufacturing operations in each building and/or area, these COPCs were identified:

- TPH, including Stoddard solvent;
- PCBs (as total Aroclors);
- VOCs;
- metals, including hexavalent chromium [Cr (VI)]; and
- semi-volatile organic compounds (SVOCs).

Based on Alcoa's historical groundwater monitoring results, TCE, 1,2-DCA, and chloroform were identified as groundwater COPCs at the Site.

A Phase II investigation was conducted as the initial remedial investigation at the Site between November and December 2005. The investigation was conducted to evaluate whether the RECs or OECs identified in the Phase I ESA had resulted in releases to the subsurface soil and/or groundwater at the Site. The initial remedial investigation included the collection and analysis of concrete, soil vapor, and soil samples for a number of constituents. The findings of the investigation were submitted to the City of Vernon H&EC in a report dated March 9, 2006 (Geomatrix, 2006b).

Soil and soil vapor data collected during the Phase II investigation were evaluated using a stepped screening process to evaluate the potential for groundwater impacts and the potential for risks to human health due to exposure to shallow soil containing COPCs. The initial step of the screening process was to assess potential VOC impacts and the need to collect additional soil samples. Based on the soil vapor results obtained in Building 106, the collection and analysis of additional soil samples were required to further investigate potential VOC impacts.

The second step of the screening evaluation included a comparison of the Phase II soil sample results to the following prescriptive regulatory screening levels.

- RWQCB Interim Site Assessment and Cleanup Guidebook (May 1996, and updated March 2004) groundwater protection screening levels for carbon range-specific petroleum hydrocarbons and aromatic hydrocarbons (BTEX compounds) in soil. The selected screening levels were obtained from Table 4-1 of the above-referenced RWQCB guidance assuming a sand lithology and a depth to groundwater of 150 feet.
- U.S. EPA Region IX Preliminary Remediation Goals (PRGs) for industrial sites and concentrations for VOCs, SVOCs, PCBs, and metals in soil (U.S. EPA, 2004).
- U.S. EPA Region IX soil screening levels (SSLs) for the protection of groundwater using a default dilution attenuation factor of 20 (DAF20) for VOCs, SVOCs, and metals, where available (U.S. EPA, 2004).
- California Background Concentrations of Trace and Major Elements in California Soil (Bradford, et. al., 1996).
- California Code of Regulations, Title 22, Total Threshold Limit Concentration and Soluble Threshold Limit Concentration for metals and PCBs in building materials (waste characterization).

Based on the data collected during the Phase II investigation and the above screening evaluation process, certain areas at the Site were identified as impacted by one or more COPCs at concentrations above the screening criteria. Although the screening criteria are not intended to be remediation goals, they were used to evaluate the potential need for further action (such as additional investigation, analysis, or potential remediation). Remediation goals

may differ from screening levels based on site-specific considerations (e.g., redevelopment, future land use, potential exposure pathways, etc.), regulatory requirements, evaluation of risk, or other relevant factors as set forth in NCP 40 CFR 300.

The following areas of the Site had COPCs that exceeded one or more of the screening criteria (the boring locations discussed below are shown on Figure 6). For each of these areas, the results of the Phase II investigations indicated that additional investigation was required and the City of Vernon H&EC approved these subsequent investigatory actions on March 20, 2006.

- Building 104 – PCBs were detected in the concrete slab and soil to a depth of 3 feet bgs adjacent to the location of a saw (borings 41, 73, and 74). Additional soil borings were required in the vicinity of the saw to assess the source and extent of PCBs detected in concrete and the underlying soil.
- Building 104 – PCBs were detected in soil to a depth of approximately 71.5 feet bgs in the vicinity of a vertical pit and a former vertical pit (boring 40). Additional soil borings were required near both vertical pits to assess the source and extent of PCBs detected in soil.
- Buildings 106 and 108 – TCE was detected in soil beneath the northern portion of the buildings to a depth of approximately 48 feet bgs (boring 14), and TCE was detected in soil vapor. Additional investigation of the lateral extent of TCE in soil and its potential impacts to groundwater was required in this area.
- Building 112 (former etch station) and near storm water outfall #6 – one or more metals were detected in soil to a depth of 6 feet bgs (boring 113). Additional investigation of the lateral extent of metals in shallow soil was required in these areas.
- Former substation #8 – PCBs were detected in the soil and gravel drainage area of the former substation to a depth of 2.2 feet bgs (boring 39), but they were not detected in the soil boring adjacent to the drainage area. Additional investigation of the depth of the soil and gravel drainage area and the concentrations of PCBs in these materials was required.

Although concentrations of COPCs in other areas of the Site did not exceed screening criteria, additional remedial investigations were required by the City of Vernon H&EC at three locations to further understand the source of the deeper soil impacts and to confirm that soil concentrations were not increasing with depth. These three locations are listed below.

- Building 106 – Stoddard solvent-range petroleum hydrocarbons were detected in one soil sample at a depth of approximately 46.5 feet bgs (boring 13). Because these hydrocarbon compounds were not detected in shallow soil at this boring or in soil vapor in the vicinity of the boring, further investigation of the source of these compounds at 46.5 feet bgs in soil was required.

- Building 112 – TPH concentrations in soil increased with depth at a boring drilled to a depth of 9.6 feet adjacent to a former sump (boring 30). Although the hydrocarbon concentrations were below the screening levels, their vertical extent in soil adjacent to the sump had not been characterized and required further evaluation.
- Cooling Tower area – Cr (VI) and PCBs (Aroclor-1248) were detected in one soil sample from boring 46 at a depth of 21.1 feet bgs (the bottom of the boring). PCBs and Cr (VI) were not detected in shallow soil samples collected from boring 46, and therefore, further investigation of the source of PCBs and Cr (VI) detected at 21.1 feet bgs in soil was required.

### **3.3.2 Supplemental Phase II Investigations**

The Phase II remedial investigation results indicated a need to 1) assess the extent of impacted soil exceeding the screening criteria, 2) assess potential impacts to groundwater, and 3) further understand the subsurface conditions at the Site for each of the areas identified in Section 3.3.1. Therefore, a Supplemental Phase II investigation was required in specific areas of the Site to further characterize the extent of impacted soil and/or existing subsurface conditions for the reasons described above in Section 3.3.1. On March 9, 2006, Geomatrix submitted a proposed plan to the City of Vernon H&EC to further characterize the extent and potential significance of COPCs exceeding screening criteria in soil at the Site and the potential impacts to groundwater related to TCE detections in soil and soil vapor in Buildings 106 and 108. On March 20, 2006, the City of Vernon H&EC approved the Supplemental Phase II investigation plan, and the investigation was conducted between March 28, 2006 and April 24, 2006.

Based on the findings of the initial Supplemental Phase II investigation, a follow-up investigation was required to further characterize the extent of VOCs detected in soil, soil vapor, and groundwater in the north portion of the Site. In a letter to the City of Vernon H&EC dated May 9, 2006, Geomatrix identified additional sampling points in Buildings 106, 108, and 112. Under approval and direction from the City of Vernon H&EC, the additional investigation work began on May 11, 2006 and was completed on May 24, 2006. The findings of the Supplemental Phase II investigation were submitted to the City of Vernon H&EC in a report dated December 19, 2006 (Geomatrix, 2006c).

Soil data collected during the Supplemental Phase II investigation were evaluated using the stepped screening process discussed in Section 3.3.1, and sample locations where COPCs were detected above the screening levels are described in Section 3.6.

### **3.3.3 Geomatrix Concrete Characterization for PCBs as Aroclors**

In addition to the concrete testing conducted during the Phase II investigation, coring and testing of the concrete slabs and concrete transformer pads were performed during and after

above-grade demolition work to further characterize PCB-impacted concrete. PCBs were detected in concrete samples at “total Aroclor” concentrations (the sum of detected Aroclor-1016, -1221, -1232, -1242, -1248, -1254, and -1260) greater than 1 mg/kg in portions of Buildings 104, 106, 108, 110, 112, and 112A. A summary of PCBs as total Aroclor concentrations for the concrete samples is depicted on Figure 7. The results for all tested Aroclors (Aroclor-1016, -1221, -1232, -1242, -1248, -1254, and -1260) are provided in Appendix A.

### **3.4 AMEC SUPPLEMENTAL SOIL VAPOR TESTING**

As a continuation of the remedial investigation work at the Site, Pechiney was directed by DTSC to conduct an off-site soil vapor survey at the intersection of Fruitland and Boyle Avenues near the northwest corner of the Site in July of 2009. DTSC required the work to assess the off-site extent of VOC concentrations in shallow soil vapor in the vicinity of former Building 106. In addition, and in order to meet DTSC’s requirements for evaluating human health risk related to vapor intrusion, a shallow soil vapor survey was conducted within the footprint of Building 112A and to the west to the building in the vicinity of the former Stoddard solvent UST area. This work was required due to the lack of soil vapor data. The soil vapor survey was conducted to complete the HHRA for potential indoor air exposure to Stoddard solvent and associated compounds. The findings of this work are provided in this FS and tabulated analytical results are included in Appendix A. Sample locations are shown on Figure 6. Based on the off-site soil vapor testing conducted in July 2009, the sample results indicated the following.

- TCE and tetrachloroethene (PCE) were detected in all shallow soil vapor samples (locations 161 through 164) at depths of 5 and 15 feet. Other VOCs, 1,1,1-trichloroethane (1,1,1-TCA; location 163 at 15 feet) and 1,1-dichloroethene (1,1-DCE; at sample location #164 at 15 feet) were detected in only one sample each. No other VOCs were detected.
- TCE soil vapor concentrations decreased to the north, northwest (with the exception of the 15-foot sample at 164), and west of the Site, while the PCE soil vapor concentrations increased. TCE and PCE soil vapor concentrations also increased with depth. Assuming the suspected on-Site source area for the site-derived TCE is present in the northwest corner of the Site, a threefold decrease in the concentration of TCE in soil vapor was measured between the on-Site sample location 81 and the off-site sample location 162, approximately 60 feet north. This reduction in concentration was also observed to the west between on-Site sample location 82 and off-site sample location 164. Based on this observation, the site-derived VOCs will continue to decrease at further distances from the Site and co-mingle with other potential source(s) in a highly industrial area.
- The highest PCE soil vapor concentration was detected at the furthest point from the Site on Fruitland Avenue (at sample location 163, see Figure 6). At this sample location, the TCE concentration in the 15-foot sample also was higher than the

15-foot sample results obtained for TCE at the two off-site sample locations (162 and 164) closer to the Site. The higher PCE concentrations at the off-site sample location suggest the presence of an off-site source or sources of VOCs. For example, sample location 163 is approximately 140 feet northwest of the Site, and approximately 300 feet east of the former solvent recycling facility (referred to as Detrex Solvent Division Facility located on Fruitland Avenue and listed with a land use deed covenant in EnviroStor<sup>1</sup>). At this former facility, a soil removal action was conducted in 2001 to a depth of 20 feet in a localized area that exhibited elevated concentrations of PCE in soil (1100 mg/kg at 4 feet) and soil vapor (34 milligrams per liter at 20 feet) (URS, 2002). Other VOCs, TCE and 1,1,1-TCA, also were detected but at a much lower concentrations. In addition, a recent investigation conducted by Tetra Tech Inc. (May 2011) at a facility located on Fruitland Avenue, approximately 700 feet west of the Site also identified PCE and TCE in soil vapor. At this facility, PCE and TCE were detected in soil vapor at 5 and 20 feet below grade at concentrations up to 100 µg/L, with the highest concentration reported for PCE in a hazardous materials storage area.

- Calculated molar ratios of PCE to TCE (0.10 and 0.42) are an order of magnitude higher at three of the off-site soil vapor sample locations 162, 163, and 164. The molar ratios calculated for the on-Site samples located in the suspected on-Site source area ranged between 0.01 and 0.087. The distribution of PCE to TCE is presented graphically on Figures 8 and 9. The PCE to TCE molar ratios further suggest the probability of an off-site source or sources of PCE and TCE in the vicinity of the off-site sample locations 162, 163, and 164.

### 3.5 AMEC SUPPLEMENTAL GROUNDWATER TESTING

Based on a request from DTSC, a groundwater sampling event was conducted at the Site in May 2011 for VOC and perchlorate testing. Monitoring wells AOW-6 and AOW-8 were redeveloped and sampled in May 2011. Monitoring well AOW-9 could not be developed or sampled due to a migratory bird nesting near the well location. Perchlorate and VOCs were not detected in the groundwater samples collected from AOW-6 and AOW-8. Analytical results from this sampling event are included in Appendix A, and the monitoring well locations are shown on Figure 2. Historically, groundwater samples from AOW-8 contained 1,2-DCA, TCE and chloroform, with TCE and 1,2-DCA detected above the respective maximum contaminant levels (MCLs). As discussed in Section 3.6, the presence of these compounds in groundwater may be attributed to an off-site source, and the reduction in VOC concentrations to non-detected levels at AOW-8 indicates natural attenuation of VOCs is already occurring in groundwater beneath the Site.

### 3.6 AMEC SUPPLEMENTAL SOIL AND CONCRETE CHARACTERIZATION

In July 2009, AMEC submitted a PCBNP (AMEC, 2009) to U.S. EPA for approval of a risk-based application for on-Site remediation of PCB releases and disposal of PCB-remediation

<sup>1</sup> EnviroStor, February 2012



waste (soil and concrete). The PCBNP was prepared in compliance with the 40 CFR 761 (Subchapter R, TSCA), including applicable amendments (June 29, 1998, 40 CFR Parts 750 and 761, Disposal of Polychlorinated Biphenyls, Final Rule). Following U.S. EPA's review of the risk-based application, U.S. EPA required additional testing, which included the following:

- collection and analysis of additional concrete cores for PCBs as Aroclors from 50 randomly selected concrete slab areas;
- collection and analysis of soil directly beneath PCB-impacted concrete slabs (referred to as sub-slab soil samples), where the total Aroclor concentration of the concrete slab exceeded the then proposed remediation goal of 5.3 mg/kg for concrete; and
- collection and analysis of additional soil and concrete for PCBs as Aroclors and dioxin-like PCB congeners to support the HHRA and proposed risk-based remediation goals for PCBs.

Specific protocols and sampling requirements were outlined in a draft Sampling and Analysis Plan (SAP; AMEC, 2010), which was submitted to U.S. EPA pursuant to its conditional approval of the PCBNP (U.S. EPA, 2010a). The SAP was approved with modifications by U.S. EPA on August 30, 2010. The sampling covered under the SAP was conducted between September 9, 2010 and October 18, 2010, with final laboratory analytical data received on November 8, 2010. The analytical results of the additional PCB (tested Aroclors and sum of detected Aroclors) concrete and soil sampling are provided in Appendix A; a summary of the total Aroclor concentrations for the 2010 concrete samples are shown on Figure 7.

### **3.7 AREAS OF IMPACT**

Although the screening criteria described in Section 3.3.1 are not intended to be remediation goals, one or more COPCs were detected in soil and/or concrete at concentrations above these screening criteria during the Phase II and Supplemental Phase II investigations conducted by Geomatrix and AMEC. The areas identified as impacted by one or more COPCs with concentrations exceeding these initial screening criteria are described below and sample locations are shown on Figures 6 and 7.

With the exception of storm water outfalls #6 and #7 and former hot well area, these areas were not previously identified as being impacted by VOCs or PCBs.

- Northern Portion of Buildings 106, 108, and 112 – TCE was detected in soil vapor, soil, and groundwater in the northwestern portion of the Site. Data collected to date indicate the likely presence of a source of VOCs in soil and groundwater in the northwest corner of Building 106. TCE and PCE concentrations detected in soil exceed the U.S. EPA Region IX SSL for the protection of groundwater (using a DAF20) in this area. TCE was detected in groundwater samples collected from a

depth of approximately 150 feet bgs at concentrations ranging from 72 µg/L to 420 µg/L. In addition, PCBs were detected in the concrete slab in portions of these buildings, and PCBs were detected in sub-slab soil samples at three discrete locations between Building 106 and 108 (sample locations 191, 193 and 195).

- Off-site Northwest of Building 106 – the investigation of off-site soil vapor concentrations to the northwest of Building 106, at the intersection of Fruitland and Boyle Avenues, identified TCE and PCE in shallow soil vapor samples at depths of 5 and 15 feet (sample locations 161 through 164; Figures 8 and 9). At these off-site locations, TCE soil vapor concentrations decreased to the north, northwest and west of the Site, while the PCE soil vapor concentrations increased. For comparison, the molar ratios of PCE to TCE (0.10 and 0.42) were an order of magnitude higher at three of the off-site soil vapor sample locations. The molar ratios calculated for the on-Site samples from the suspected source area ranged between 0.01 and 0.087. The observed higher PCE concentrations and PCE to TCE molar ratios suggest the probability of an off-site source or sources of PCE and TCE in the vicinity of the off-site sample locations (162, 163, and 164).
- Southern Portion of Building 106 – aromatic VOCs, primarily benzene, were detected in soil and groundwater in the southern portion of the building at borings 125 and 135. Benzene was detected in groundwater samples at concentrations ranging from 2.8 µg/L to 3.3 µg/L. PCBs also were detected in the concrete slab at the southwest corner of this building, and at isolated locations within the sub-slab soil (sample locations S-1 and #39) underlying the concrete slabs.
- Storm Water Outfall #7 – PCBs were detected in soil at a depth of 5.7 feet bgs at boring 182.
- Existing and Former Vertical Pits in Building 104 – PCBs were detected in soil to a depth of 31 feet bgs at boring 98 and at depths between 10 and 71.5 feet bgs at borings 40, 94, 95, and 189.
- Northwestern Portion of Building 104 – PCBs were detected in the concrete slab at the northwest corner of the building. PCBs were not detected in soil samples from borings 115, 116, 117, 118, and 119 located in this area of the building or from the sub-slab sample locations 215 through 225.
- Saw Area in Building 104 – PCBs were detected in soil to a depth of 3 feet bgs at borings 41, 73, and 100 and from the sub-slab soil borings 228 through 233 and #236. PCBs also were detected in the overlying concrete slabs near these boring locations and surrounding the location of the saw.
- Former Hot Well area – PCBs were detected in soil at a depth of 2.7 feet bgs at boring 175.
- Building 112A and West of Building 112A – Stoddard solvent and associated VOC compounds (naphthalene, trimethylbenzenes [TMBs], and xylenes) were detected in soil vapor at depths of 5 and 15 feet bgs.



- Former Scalper/Planar Area – PCBs were detected in soil at a depth of 0.8 feet bgs at boring 183.
- Near Storm Water Outfall #6 – copper and lead were detected at a depth of 6.2 feet bgs at former boring 47, and arsenic was detected at a depth of 6.0 feet bgs at boring 113. PCBs also were detected in soil at a depth of 4.5 feet bgs at boring 176.

In order to further evaluate these areas of impacted soil vapor, soil or concrete, the Phase II data, the Supplemental Phase II investigation data, and all other COPCs detected in soil and soil vapor at the Site were evaluated for potential human health risks using a screening-level HHRA pursuant to NCP 40 CFR 300.430(d)(1) and DTSC guidance documents. The screening-level HHRA is presented in Section 4.0. The potential impacts of these COPCs to groundwater are evaluated in Section 4.3.

### 3.8 GROUNDWATER IMPACTS AND NATURAL ATTENUATION

Groundwater samples collected at the Site contain TCE at concentrations above the MCL, and based on Site data and the reported groundwater flow direction (west-northwest), there are at least three potential sources of TCE and VOCs in groundwater as described below. Tabulated groundwater analytical results are included in Appendix A.

- Northwest portion of the Site: TCE impacts to groundwater in this portion of the Site may be attributed, to some degree, to historical manufacturing operations in the northwestern portion of the Site (e.g. Building 106 as described further in Section 3.6). This statement is based on the detection of TCE and other VOCs in the northwest portion of the Site in soil, soil vapor, and groundwater samples. In this area of the Site, TCE was detected in hydropunch groundwater samples from sample locations 125, 126, 132, 133, and 134 at concentrations ranging between 71 µg/L and 420 µg/L.
- Off-site Source(s) to the south, southeast, and southwest: TCE and other VOC impacts to groundwater in the southern portion of the Site, near the former Stoddard solvent USTs, may be attributed to an off-site source or sources. This statement is based on the fact that TCE or other related VOCs were not detected in soil and soil vapor samples collected in the southern portion of the Site. Historical records reviewed at the RWQCB and on GeoTracker<sup>2</sup>, suggest the presence of several off-site sources including the former Bethlehem Steel site, located upgradient of the Site (just south of Slauson Avenue – aka Vernon Parcels/Lots) and the former Trico site located southwest of the intersection of Boyle Avenue and Slauson Avenue (Environmental Audit Inc., 2009). In addition, detected concentrations of the chlorinated VOCs, 1,2-DCA, chloroform, and TCE in groundwater in the southern portion of the Site (former monitoring wells AOW-3 and AOW-7 and existing monitoring wells AOW-8, and AOW-9; see Figure 2) have decreased (attenuated) since the initial sampling event in 1991.

<sup>2</sup> GeoTracker, February 2012

- Off-site source(s) to the east: TCE impacts to groundwater may be present to the east of the Site, beyond Alcoa Avenue. This is based on historical groundwater data collected from a former Alcoa monitoring well AOW-4, which was located in the northeast corner of the original Alcoa property (see Figure 2) near the intersection of Alcoa Avenue and Fruitland Avenue. During previous monitoring events, TCE was detected in the groundwater samples from monitoring well AOW-4 at concentrations up to 220 µg/L, indicating the presence of another potential regional source of TCE in groundwater east of the Site. In addition, the TCE concentrations reported for monitoring well AOW-4 decreased with time since the initial sampling event in 1990.

### **3.9 ABOVE-GRADE FACILITY DEMOLITION**

Facility above-grade and below-grade demolition is being conducted separately; the above-grade hazardous materials abatement and demolition work was completed at the Site in November 2006 under the direction of the City of Vernon H&EC. The concrete building slabs (including those impacted by PCBs) and surrounding pavements were not removed during the above-grade demolition work. These features remain in-place and will be removed as part of the below-grade demolition work. Additional testing of the concrete slabs for PCBs has been conducted and was summarized earlier in Sections 3.3.3 and 3.6. A summary of the above-grade demolition work is included in the Above Grade Demolition Completion Report dated December 26, 2006 (Geomatrix, 2006d).

### **4.0 SCREENING-LEVEL HUMAN HEALTH RISK ASSESSMENT**

This section presents the SCM developed for the Site and the screening-level HHRA conducted to evaluate potential human health risks associated with exposures to COPCs pursuant to NCP 40 CFR 300.430(d)(1) and DTSC guidance documents. Ecological receptors were not evaluated because the Site and surrounding areas are highly industrialized, providing poor quality habitat for such receptors. Furthermore, U.S. Fish and Wildlife Service determined the Site was not located within the vicinity of any federally listed species, their designated critical habitat, or other Federal trust resources under their jurisdiction (February 1, 2010 email communication with Bill Miller of the U.S. Fish and Wildlife Service).

This screening-level HHRA was conducted for individual "Phase areas" at the Site. Phase areas were developed to facilitate future below-grade demolition work and the anticipated plans for future site use(s); which may include the construction and operation of a power plant and/or commercial/industrial facilities. The "Phase" terminology is not meant to represent a sequential order of implementation of the below-grade demolition, but describes the primary locations where the work will be conducted. The Phase I through VI areas related to the layout of the Site are briefly described below. The phase areas are shown on Figure 3.

- The Phase I and II areas cover the majority of the Site and include former Buildings 104, 106, 108, 110, 112, and the northern portion of Building 112A.
- The Phase III area includes the hot well/cooling tower area and adjacent pavements that are located outside the buildings, including the former UST area southwest of Building 112A known to contain Stoddard solvent-impacted soil. This area was separated further to distinguish the hot well/cooling tower area (the Phase IIIa area) from the Stoddard solvent-impacted former UST area (the Phase IIIb area).
- The Phase IV area includes former Building 112A and has known Stoddard solvent soil and soil vapor impacts.
- The Phase V area includes Parcel 6 located south of Building 112A.
- The Phase VI area includes the eastern parking lot and paved areas.

#### 4.1 SITE CONCEPTUAL MODEL

As described in U.S. EPA's "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (U.S. EPA, 1988), the purpose of a SCM is to describe what is known about chemical sources, migration pathways, exposure routes, and receptors at a Site. The SCM depicts the exposure pathways and the mechanisms by which a receptor may come into contact with COPCs in the environment. Using the U.S. EPA Risk Assessment Guidance for Superfund (U.S. EPA, 1989), potential exposure pathways applicable to the Site have been identified and addressed. An exposure pathway is defined by four elements (U.S. EPA, 1989):

- a source and mechanism of COPC release to the environment;
- an environmental medium of concern (e.g., air, soil) or transport mechanism (e.g., volatilization) for the released COPC;
- a point of potential contact with the medium of concern; and
- an exposure route (e.g., ingestion) at the contact point.

An exposure pathway is considered "complete" if all four of these elements are present. Only complete exposure pathways need to be evaluated for the purposes of a risk assessment. The characterization of the potential exposure pathways at the Site, based on existing information, is presented in the SCM (Figure 10).

There is no current use of the Vernon Facility, but the property is being purchased by the City of Vernon for commercial/industrial use with the potential for a portion of the Site to be used as a power plant. Based on U.S. EPA's directive requiring the consideration of reasonably anticipated future land use (U.S. EPA, 1995), potential future human receptors at the Site include commercial/industrial workers and construction workers involved in the future

construction and grading at the Site. The construction worker receptor is assumed to spend 100 percent of his time outdoors and encompasses potential exposure of future short-term utility maintenance workers. The commercial/industrial worker receptor is assumed to spend 100 percent of his time indoors or outdoors; exposure was evaluated separately for indoor and outdoor receptors. No other land use (i.e., residential) is reasonably anticipated for the Site based on the assumption that a land use covenant will be issued for the property restricting zoning and use of the Site to commercial/industrial purposes. Furthermore, the City of Vernon zoning laws prohibits new residential development within the City of Vernon, further supporting a no-residential development scenario.

Various fate and transport mechanisms also may result in the off-site movement of some COPCs. COPCs in subsurface soil vapor may move laterally through fractures, utility conduits, or other preferential pathways; COPCs in groundwater may move off-site with groundwater flow. Furthermore, COPCs in soil may move off-site as wind-blown fugitive dust. This HHRA also considered off-site receptors such as workers at adjacent or nearby commercial/industrial facilities or short-term utility workers performing excavation and maintenance activities in adjacent roadways.

As discussed in Section 3.0, prior remedial investigations identified TPH, PCBs, VOCs, and metals in soil; PCBs in concrete; and VOCs in soil vapor and groundwater. The identification of potentially complete exposure pathways for the COPCs in each exposure medium is discussed below.

#### **4.1.1 Potential Exposure to COPCs in Soil**

According to the City of Vernon H&EC, the depth of future below-grade excavation at the Site will encompass the upper 15 feet of soil (City of Vernon H&EC letter dated February 6, 2007; City of Vernon H&EC, 2007). Exposure of future construction workers was therefore considered potentially complete within the upper 15 feet of soil. It was also assumed that these soils could be redistributed at the land surface during excavation and grading, creating potential future exposure to outdoor commercial/industrial workers. The exposure pathways considered potentially complete for COPCs in soil for both construction workers and outdoor commercial/industrial workers and evaluated in the HHRA include:

- incidental ingestion of soil;
- dermal contact with soil; and
- inhalation of particulates in ambient air.

Exposure also was considered potentially complete for the volatile COPCs in soil via inhalation of these compounds in ambient air for outdoor commercial/industrial workers and construction

workers and via inhalation of these compounds in indoor air for indoor commercial/industrial workers. Because soil vapor data are considered to be more appropriate than soil data for evaluating potential vapor exposure, soil vapor samples collected in each Phase area of the Site (except for the Phase VI area where VOCs were not detected in soil) were used instead of soil data to evaluate potential vapor movement to air and inhalation exposure (Section 4.1.4).

Off-site, exposure to COPCs in on-Site soil was considered potentially complete for outdoor commercial/industrial workers and utility maintenance workers through inhalation of particulates and VOCs in ambient air. Exposure may also be potentially complete for indoor commercial/industrial workers to VOCs moving into indoor air. However, for COPCs detected in on-Site soil or soil vapor, the evaluation of on-Site exposures was assumed to be protective of off-site exposures. Potential off-site exposure to site-related COPCs in soil vapor at the intersection of Fruitland and Boyle Avenues was evaluated separately, as described in Section 4.1.4 below.

#### **4.1.2 Potential Exposure to COPCs in Concrete**

Concrete present in former building slabs may be demolished on-Site, crushed, and reused as fill material in excavation and foundation removal areas. A letter from the City of Vernon H&EC dated February 6, 2007, required Pechiney to implement alternative criteria in addition to a risk-based approach for the reuse of PCB-impacted concrete as fill material (City of Vernon H&EC, 2007). To address this requirement, alternative criteria were developed on the basis of potential exposures to PCBs in crushed concrete. Potential exposures were considered for 1) construction workers who may be potentially exposed to PCBs in crushed concrete during construction at the Site; and 2) outdoor commercial/industrial workers, who may be exposed if crushed concrete is left uncovered at the surface. Exposure to PCBs in crushed concrete was considered potentially complete for these outdoor workers via the pathways identified above for exposure to COPCs in soil.

#### **4.1.3 Potential Exposure to COPCs in Groundwater**

Prior remedial investigations identified VOCs in groundwater beneath the Site, specifically at a depth of approximately 150 feet bgs in the first water-bearing unit (interpreted to be the upper portion of the Exposition aquifer). Because VOCs in groundwater have the potential to partition into the vapor phase and move into indoor or ambient air, inhalation of VOCs from groundwater was considered potentially complete for all receptors. Indoor inhalation was evaluated to be protective of all receptors. It was also assumed that, for VOCs detected in on-Site groundwater, this evaluation would be protective of off-site exposures.

According to information provided by the City of Vernon H&EC, groundwater is produced off-site from the Jefferson, Lynwood, Silverado, and Sunnyside aquifers at depths greater than

450 feet bgs (Section 2.3.2.2). On-Site use of groundwater found in the first water-bearing unit will be restricted as part of the land use covenant to be issued for the Site. Although groundwater from the first water-bearing unit is not used for potable supply, the RWQCB Basin Plan (RWQCB, 1994) designated groundwater in the Site vicinity for beneficial use. Therefore, the potential exposure to impacted site groundwater found in the upper portion of the Exposition aquifer will be evaluated. Furthermore, the potential threat of COPC movement from soil or concrete to groundwater will also be evaluated.

#### **4.1.4 Potential Exposure to COPCs in Soil Vapor**

Prior remedial investigations identified VOCs in soil vapor, specifically at depths of 5 and 15 feet bgs, in on-Site Phase areas (e.g., in the Phase I, III and IV areas) and off-site at the intersection of Fruitland and Boyle Avenues. Because VOCs in soil vapor have the potential to move into indoor or ambient air, inhalation of VOCs in soil vapor was considered potentially complete for all receptors. Furthermore, because soil vapor is considered a more appropriate medium than soil for assessing potential vapor movement to air, shallow soil vapor data were used in lieu of soil data to evaluate potential risks associated with vapor movement from the vadose zone. Potential indoor inhalation exposure to site-related VOCs in the off-site soil vapor sample locations was evaluated to be protective of potential off-site exposures.

Potential vapor movement of VOCs in groundwater to indoor air was also evaluated (as described in Section 4.1.3) to differentiate vadose zone from groundwater impacts.

## **4.2 DEVELOPMENT OF SCREENING LEVELS AND HUMAN HEALTH RISK ASSESSMENT**

Potential human health risks for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers were evaluated using screening levels as described herein. AMEC developed risk-based screening levels (RBSLs) protective of complete exposure pathways using the methodology presented by the Office of Environmental Health Hazard Assessment (OEHHA) for California Human Health Screening Levels (CHHSLs) (OEHHA, 2005), and accounting for recent OEHHA and DTSC guidance documents (OEHHA, 2009; DTSC, 2009). However, RBSLs were developed to be consistent with exposure parameters recommended by the DTSC (DTSC, 2005).

This screening-level HHRA followed guidelines specified in U.S. EPA and California Environmental Protection Agency (Cal-EPA) for the performance of risk assessments as specified in the following documents:

- Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A), U.S. EPA, Office of Emergency and Remedial Response, December 1989 (U.S. EPA, 1989);



- Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities, Cal-EPA, DTSC, Office of the Science Advisor, July 1992, corrected and reprinted, 1996 (DTSC, 1996);
- Preliminary Endangerment Assessment Guidance Manual, Cal-EPA, DTSC, 1999 (DTSC, 1999a); and
- Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil, OEHHA, updated January 2005 (OEHHA, 2005).

Other regulatory reference documents were used as appropriate to supplement the information in these documents.

#### 4.2.1 Data Evaluation

The analytical data used for the HHRA were those data collected prior to and during the Geomatrix Phase II, Supplemental ESAs, and recent sampling events as presented in Appendix A. Collectively, these data constitute the remedial investigation data for the Site. Data excluded from consideration are listed below.

- Metals in soil with concentrations less than site-specific background concentrations established pursuant to DTSC guidance (1997). The derivation of site-specific background concentrations is presented in Appendix B.
- Data for total recoverable petroleum hydrocarbons (TRPH) and undifferentiated TPH in soil. Because the specific hydrocarbon ranges associated with these non-discrete TPH mixtures are not understood, toxicity criteria based on values for specific hydrocarbon ranges from DTSC guidance (DTSC, 2009) could not be derived for these mixtures. Furthermore, because available RWQCB criteria for potential impacts to groundwater (RWQCB, 1996) are also based on specific hydrocarbon ranges, detected concentrations of TRPH and undifferentiated TPH in soil were not screened for potential leaching concerns. Potential hazards from exposure to the remaining TPH mixtures in soil and soil vapor were evaluated using toxicity criteria for specific hydrocarbon ranges as described in Appendix C. The remaining TPH mixtures were also evaluated for potential impacts to groundwater based on comparisons to RWQCB criteria (RWQCB, 1996) (Section 4.3).
- Data from soil samples collected below 15 feet bgs. Based on the SCM (Figure 10), direct exposure to COPCs in deep soil (greater than 15 feet bgs) is considered incomplete. However, data from all soil samples were used to evaluate potential future impacts to groundwater, with PCBs and several VOCs exceeding the screening criteria for potential impacts to groundwater and subsequently subjected to more detailed leaching and migration modeling analysis as described in Section 4.3.
- Data from soil samples no longer in place following excavations (including excavation of dip tanks, sumps, storm water outfall discharge areas, waste disposal pits, and USTs). These samples are marked as “excavated” or “E” in Appendix A.

The COPCs identified after data evaluation and carried through the quantitative HHRA are listed below. The COPCs identified in shallow soil (0 to 15 feet bgs) included:

- VOCs – acetone, benzene, n-butylbenzene, sec-butylbenzene, ethylbenzene, isopropylbenzene, isopropyltoluene, naphthalene, PCE, n-propylbenzene, TCE, toluene, 1,2,4-trimethylbenzene (1,2,4-TMB), 1,3,5-trimethylbenzene (1,3,5-TMB), total xylenes, m,p-xylenes, and o-xylene.
- Metals – arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, silver, thallium, vanadium, and zinc.
- TPH – TPH as gasoline, TPH as diesel, TPH as motor oil, TPH as Stoddard solvent, TEPH, c6-c10 hydrocarbons, c10-c20 hydrocarbons, c10-c28 hydrocarbons, and c21-c28 hydrocarbons.
- PCBs – Aroclor-1016, -1232, -1248, -1254, and -1260. Dioxin-like PCB congeners were also considered COPCs in shallow soil, but sampling for these congeners was limited and specifically conducted for comparative purposes. A separate evaluation was conducted with the available data to address the concern that such congeners may be present at the Site at more significant concentrations, in terms of potential human health risk, than the PCBs as Aroclor mixtures. Because of the limited data, dioxin-like PCB congeners were not included in HHRA calculations by Phase area, but were evaluated separately as discussed in Section 5.2.2.1.

Aroclor-1016, -1248, -1254, and -1260 were identified as COPCs in concrete. Dioxin-like PCB congeners detected in limited concrete samples were also considered COPCs but were evaluated separately for comparative purposes (as discussed in Section 5.2.2.1).

The COPCs identified in groundwater included benzene, chloroform, 1,1-DCE, 1,2-DCA, dichloromethane (i.e., methylene chloride), ethylbenzene, PCE, TCE, toluene, TPH as gasoline, m,p-xylenes, and o-xylene.

The COPCs identified in shallow soil vapor (5 and 15 feet bgs) included chloroform, 1,2-DCA, 1,1-DCE, naphthalene, PCE, TCE, toluene, TPH as Stoddard solvent, 1,1,1-TCA, 1,2,4-TMB, 1,3,5-TMB, m,p-xylenes, and o-xylene.

#### 4.2.2 Risk-Based Screening Levels

RBSLs were developed for each receptor (i.e., indoor commercial/industrial worker, outdoor commercial/industrial worker, and construction worker) for the media to which that receptor is exposed. The methodology used to develop the RBSLs is presented in Appendix C. Tables 1 through 3 present a summary of the RBSLs developed for each receptor for the COPCs in soil, groundwater, and soil vapor, respectively. Notable modifications from the CHHSL methodology (OEHHA, 2005) to account for more current guidance (DTSC, 2009; OEHHA, 2009) and certain exposure pathways are described below.



**Lead** – As required by DTSC, RBSLs were developed for lead in soil using the U.S. EPA's Adult Lead Model (ALM) (U.S. EPA, 2005) for outdoor commercial/industrial workers and the DTSC's LeadSpread model (Version 7.0) (DTSC, 1999b) for construction workers. LeadSpread was used assuming construction work would not be performed by childbearing adults.

**TPH** – As required by DTSC, RBSLs were developed for non-discrete TPH mixtures at the Site following DTSC guidance for Evaluating Human Health Risks from Total Petroleum Hydrocarbons (DTSC, 2009). DTSC-recommended physiochemical properties and toxicity criteria for specific aliphatic and aromatic hydrocarbon ranges were incorporated in the development of RBSLs. RBSLs were developed for the non-discrete mixtures by determining the aliphatic and aromatic hydrocarbon ranges typically associated with each mixture (Total Petroleum Hydrocarbon Criteria Working Group [TPHCWG], 1998; Agency for Toxic Substances and Disease Registry [ATSDR], 1999) and weighting the RBSLs appropriately. For comparative purposes, AMEC also developed "worst-case" RBSLs assuming each TPH mixture is composed of 50% aliphatic and 50% aromatic hydrocarbons as described in DTSC guidance (DTSC, 2009), and using the most health-protective toxicity criteria of the discrete hydrocarbon groups associated with each mixture.

**VOCs** – As required by DTSC, inhalation pathways were not incorporated into the development of RBSLs for the VOCs in soil because volatilization of chemicals from the subsurface to ambient or indoor air was evaluated using soil vapor data exclusively and RBSLs developed for these data. In summary, the approach for evaluating VOCs for indoor and outdoor commercial/industrial workers and construction workers consisted of the following.

- RBSLs for VOCs in soil were developed for dermal contact with soil and soil ingestion exposures for the outdoor commercial/industrial worker and construction worker.
- RBSLs for VOCs in groundwater were developed for indoor inhalation exposures for the indoor commercial/industrial worker (using the 1991 Johnson & Ettinger model) (Johnson & Ettinger, 1991). Such RBSLs were considered protective of outdoor inhalation exposures for the outdoor commercial/industrial worker, construction worker, and off-site utility worker, and indoor inhalation exposures for off-site workers at adjacent or nearby commercial/industrial facilities.
- RBSLs for VOCs in soil vapor were developed for indoor inhalation exposures to the indoor commercial/industrial worker (using the 1991 Johnson & Ettinger model) (Johnson and Ettinger, 1991) and for outdoor inhalation exposures to outdoor commercial/industrial worker and construction worker. RBSLs for indoor inhalation exposures would also be protective of off-site exposures to indoor workers at

adjacent or nearby commercial/industrial facilities, and outdoor utility workers within a trench (semi-confined air space).

**Off-site Use of Groundwater** – Potential use of groundwater was evaluated using available State or Federal MCLs instead of RBSLs.

#### 4.2.3 Risk Evaluation

The risk evaluation was conducted as a screening-level assessment to evaluate worst-case exposure scenarios and identify any chemicals contributing significantly to predicted cancer risks and noncancer hazard indexes (HI) (U.S. EPA, 1989). Risks from exposure to COPCs in soil and soil vapor were evaluated independently for each Phase area defined in Section 4.0. Potential vapor intrusion risks from VOCs in groundwater were evaluated on a site-wide basis, assuming VOCs could move laterally across Phase area boundaries before entering indoor air. Maximum concentrations of chemicals in soil, groundwater and soil vapor were identified by reviewing current and historical data. As described in OEHHA guidance (OEHHA, 2005), comparison of a chemical concentration to a CHHSL or RBSL can predict the lifetime excess cancer risk or noncarcinogenic hazard quotient (HQ) for exposure to that chemical in the exposure medium. A cancer risk ratio was calculated for exposure to each carcinogen by dividing the maximum chemical concentration by the appropriate cancer-based RBSL. Multiplying each risk ratio by the target risk level used in the development of the RBSL (i.e., one-in-one million or  $1 \times 10^{-6}$ ) then results in a predicted lifetime excess cancer risk for exposure to that chemical concentration. Similarly, for noncarcinogens, HQs were calculated by dividing the maximum chemical concentration by the appropriate noncancer-based RBSL and multiplying by the target HQ used in the development of the RBSL (i.e., 1). Cumulative effects from exposure to multiple chemicals were evaluated for each Phase area by summing the estimated chemical-specific cancer risks or HQs by exposure medium (soil and soil vapor), and then summing across these media to estimate cumulative exposure within each Phase area.

Concrete impacted with PCBs was not included in the cumulative risk evaluation. With crushed concrete proposed for re-use (or on-Site disposal) at the Site as potential fill materials, potential exposure to PCB-impacted concrete was evaluated separately using the RBSLs calculated for PCBs in soil. Concentrations of Aroclor mixtures in concrete that exceeded their respective RBSLs were identified in the following Phase areas (Appendix A).

- Phase I Area: Concentrations of Aroclor-1248, -1254, and -1260 were found to exceed the outdoor commercial/industrial worker and construction worker cancer-based RBSLs (0.53 and 3.5 mg/kg, respectively). Concentrations of Aroclor-1254 were also found to exceed the construction worker noncancer-based RBSL (2.0 mg/kg).

- Phase II Area: Concentrations of Aroclor-1248 and -1260 were found to exceed the outdoor commercial/industrial worker and construction worker cancer-based RBSLs (0.53 and 3.5 mg/kg, respectively).
- Phase IV Area: One detected concentration of Aroclor-1254 was found to exceed the outdoor commercial/industrial worker cancer-based RBSL (0.53 mg/kg).

Concentrations of dioxin-like PCB congeners in concrete were evaluated separately for comparison to the above results. Sampling for these congeners was limited and specifically collected for comparative purposes to address the concern that, based on the age of the facility and the historical manufacturing operations, the dioxin-like congeners may be present at the Site at more significant concentrations, in terms of potential human health risk, than the PCBs as Aroclor mixtures. Details of this separate evaluation are provided in Section 5.2.2.1.

Potential off-site exposure to COPCs in groundwater and off-site soil vapor were also evaluated separately. Detected concentrations of COPCs in site groundwater samples are presented in Appendix A, along with the available State or Federal MCLs. Detected groundwater sample concentrations of benzene, chloroform, 1,2-DCA, dichloromethane, and TCE exceed their respective MCLs during one or more sampling events. With the exception of dichloromethane, these COPCs were detected in groundwater as recent as the 2006 sampling event (URS, 2006). In addition, detected soil vapor concentrations of PCE and TCE in off-site soil vapor (Appendix A) were found to exceed the indoor commercial/industrial worker cancer-based RBSLs (2.2 and 6.3 µg/L, respectively).

U.S. EPA and DTSC guidance on exposure levels considered protective of human health was used to aid in the interpretation of the HHRA results. In the NCP 40 CFR 300.430(e)(i), U.S. EPA defined general remedial action goals for CERCLA sites. The goals included a range for residual cancer risk, which is “an excess upper-bound lifetime cancer risk to an individual of between  $10^{-4}$  [1E-04] and  $10^{-6}$  [1E-06],” or 1 in 10,000 to 1 in 1,000,000. The goals set in the NCP 40 CFR 300.430(e)(i)(A)(2) are applied after a decision has been made to remediate a site. A more recent U.S. EPA directive (U.S. EPA, 1991) provides additional guidance on the role of the HHRA in supporting risk management decisions, and in particular, determining whether remedial action is necessary at a site. Specifically, the guidance states, “Where cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than  $10^{-4}$ , and the noncancer HQ is less than 1, action generally is not warranted unless there are adverse environmental impacts.” U.S. EPA Region IX has stated, however, that action may be taken to mitigate risks between  $10^{-6}$  and  $10^{-4}$ , and the DTSC has established  $10^{-6}$  as the “point of departure” for cumulative lifetime excess cancer risks in the State of California.

The results of the screening-level HHRA for chemicals present in soil, groundwater, and soil vapor are presented in Tables 4 through 20 and discussed below. As is standard practice in risk assessment (U.S. EPA, 1989), this section also provides an analysis of the uncertainty in the risk-based screening process.

#### **4.2.3.1 Non-Lead Exposures**

Using maximum chemical concentrations in soil, the screening-level HHRA resulted in the predicted lifetime excess cancer risks and noncancer HQs for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers presented in Tables 4 through 10, and summarized in Table 11. Using maximum chemical concentrations in groundwater, the screening-level HHRA resulted in the predicted lifetime excess cancer risks and noncancer HQs for indoor commercial/industrial workers presented in Table 12. Using maximum chemical concentrations in soil vapor, the screening-level HHRA resulted in the predicted lifetime excess cancer risks and noncancer HQs for indoor commercial/industrial workers, outdoor commercial/industrial workers, and construction workers presented in Tables 13 through 17, and summarized in Table 18. The predicted lifetime excess cancer risks and noncancer HIs for cumulative soil and soil vapor exposures in each Phase area are presented in Table 19.

As presented in Table 12, for vapor intrusion from groundwater to indoor air, the predicted lifetime excess cancer risk for indoor commercial/industrial workers is above the DTSC point of departure ( $1 \times 10^{-6}$ ), but below the cumulative target cancer risk level of  $1 \times 10^{-5}$  proposed for the Site as described in Section 5.2 below.

As presented in Table 19, for cumulative soil and soil vapor exposures, the predicted lifetime excess cancer risks for the indoor commercial/industrial worker in the Phase I area; and the outdoor commercial/industrial worker and construction worker in the Phase I, Phase II, Phase IIIa, Phase IV, and Phase VI areas are above the DTSC point of departure ( $1 \times 10^{-6}$ ). The other cancer risks estimated were below  $1 \times 10^{-6}$ . The maximum predicted noncancer HIs for the indoor commercial/industrial worker in the Phase I, Phase IIIb, and Phase IV areas; the outdoor commercial/industrial worker in the Phase II and Phase IV area; and the construction worker in the Phase II, Phase IIIa, Phase IIIb, Phase IV, and Phase VI areas are above the DTSC point of departure for noncarcinogenic effects (less than or equal to 1). The other HIs estimated for cumulative soil and soil vapor exposures were all at or below 1, with the majority well below 1. In summary, maximum concentrations of chemicals resulted in risks or hazard indexes above target levels in the Phase I, Phase II, Phase IIIa, Phase IIIb, Phase IV, and Phase VI areas for one or more receptors.

Certain chemicals in soil and soil vapor individually contributed cancer risk levels of at least  $1 \times 10^{-6}$  or HQs of at least 1. These were considered key chemicals in each Phase area. Specifically, the following key chemicals were identified in soil and soil vapor, as presented in Tables 4 through 10 (key chemicals in soil) and Tables 13 through 17 (key chemicals in soil vapor) and as described below.

- Phase I area: Aroclor-1248 and -1260 in soil for both outdoor commercial/industrial workers and construction workers (Table 4); chloroform, PCE, and TCE in soil vapor for indoor commercial/industrial workers (Table 13).
- Phase II area: Aroclor-1232 in soil for outdoor commercial/industrial workers; Aroclor-1248, -1254, and -1260 in soil for both outdoor commercial/industrial workers and construction workers; chromium in soil for construction workers (Table 5).
- Phase IIIa area: Aroclor-1248, -1254, and arsenic in soil for both outdoor commercial/industrial workers and construction workers; Aroclor-1260 in soil for outdoor commercial/industrial workers (Table 6).
- Phase IIIb area: c6-c10 hydrocarbons in soil for construction workers (Table 7); TPH as Stoddard solvent, 1,2,4-TMB, and 1,3,5-TMB in soil vapor for indoor commercial/industrial workers (Table 15).
- Phase IV area: Aroclor-1248, -1254, -1260, and arsenic in soil for outdoor commercial/industrial workers; Aroclor-1254, arsenic, cobalt, and c6-c10 hydrocarbons in soil for construction workers (Table 8); TPH as Stoddard solvent, 1,2,4-TMB, and 1,3,5-TMB in soil vapor for indoor commercial/industrial workers (Table 16).
- Phase VI area: Aroclor-1260 and arsenic in soil for outdoor commercial/industrial workers; arsenic in soil for construction workers (Table 10).

#### **4.2.3.2 Exposure to Lead in Soil**

Exposure to lead in soil was evaluated independently of exposure to the other COPCs. As described in detail in Appendix C, the RBSLs for lead in soil, developed using the U.S. EPA's ALM (U.S. EPA, 2005) or DTSC's LeadSpread (DTSC, 1999b), are based on blood-lead as a biomarker for potential health concerns. In contrast, the RBSLs for all other COPCs are based on chemical intake and chemical-specific toxicity factors.

Table 20 presents the results of comparing the maximum detected concentrations of lead in each Phase area to the RBSLs developed for commercial/industrial worker or construction worker exposures. The comparisons are presented as "risk ratios," with a ratio higher than 1 indicating that the RBSL is exceeded. As presented in Table 20, the maximum detected concentrations of lead in soil in the Phase I, Phase IIIb, Phase V, and Phase VI areas were below background. The maximum detected concentration of lead in soil in the Phase II,

Phase IIIa, and Phase IV areas were above background, but they did not exceed the RBSLs for the outdoor commercial/industrial worker or the construction worker. Based on this analysis, the concentrations of lead detected in soil at the Site are not considered to be significant with respect to potential health effects.

#### **4.2.3.3 Uncertainty**

Uncertainty is inherent in many aspects of the risk assessment process, and generally arises from a lack of knowledge of 1) site conditions, 2) toxicity and dose-response of the COPCs, and 3) the extent to which an individual will be exposed to those chemicals (U.S. EPA, 1989). This lack of knowledge means that assumptions must be made based on information presented in the scientific literature or professional judgment. While some assumptions have significant scientific basis, others have much less. Pursuant to U.S. EPA requirements (U.S. EPA, 1989), the assumptions that introduce the greatest amount of uncertainty and their effect on the noncarcinogenic and carcinogenic risk estimates must be included as part of the HHRA. The uncertainty associated with the development of RBSLs is presented in Appendix C. Uncertainty relative to data evaluation and the RBSL comparison is included herein.

- The identification of site-related COPCs was based upon the results of the sampling and analytical programs established for the Site. The factors that contribute to the uncertainties associated with the identification of COPCs are inherent in the data collection and data evaluation processes, including appropriate sample locations, adequate sample quantities, laboratory analyses, data validation, and treatment of validated samples.
- The predominant sources of uncertainty and potential bias associated with site characterization are based on the procedures used for site investigation (including sampling plan design and the methods used for sample collection, handling, and analysis) and from the procedures used for data evaluation. A relatively comprehensive sampling program was implemented to account for the chemicals most likely to be present at the Site as a result of site history and past activities. Certain assumptions were made in the interpretation of the available data for the HHRA. For example, available TPH data reported as non-discrete mixtures (TPH as gasoline, TPH as Stoddard solvent, TPH as diesel, TPH as motor oil, and TEPH) were evaluated in the context of specific aliphatic and aromatic hydrocarbon ranges. In the absence of site-specific speciation data, it was assumed that the aliphatic and aromatic hydrocarbon ranges reported by the TPHCWG (TPHCWG, 1998) and the ATSDR (ATSDR, 1999) for these types of mixtures were applicable to reported concentrations. For comparative purposes, it was alternatively assumed the TPH mixtures consisted of 50% aliphatic and 50% aromatic hydrocarbons and that the most health-protective hydrocarbon toxicity criteria would be applicable to the mixtures (Appendix C). This assumption may be conservative for the Site, given the age of the available TPH data (the majority was collected in the 1990s) and the effects of weathering which contribute to reduced concentrations of the lighter, more toxic hydrocarbons over time.



- The use of maximum detected concentrations in the screening-level HHRA represent worst-case conditions and are representative of conditions in the most impacted areas of the Site.
- One source of uncertainty that is unique to risk characterization is the assumption that the total risk associated with exposure to multiple chemicals is equal to the sum of the individual risks for each chemical (i.e., the risks are additive). Other possible interactions include synergism, where the total risk is higher than the sum of the individual risks, and antagonism, where the total risk is lower than the sum of the individual risks. Relatively little data are available regarding potential chemical interactions following environmental exposure to chemical mixtures. Animal studies suggest, however, that synergistic effects will not occur at levels of exposure below their individual effect levels (Seed, et al., 1995). As exposure levels approach the individual effect levels, a variety of interactions may occur, including additive, synergistic, and antagonistic (Seed, et al., 1995). Current U.S. EPA guidance for risk assessment of chemical mixtures (U.S. EPA, 1989) recommends conducting the risk assessment assuming an additive effect following exposure to multiple chemicals (excluding lead, given the different means by which potential health concerns are evaluated). Subsequent recommendations by other parties, such as the National Academy of Sciences (National Research Council, 1988) and the Presidential/Congressional Commission on Risk Assessment and Risk Management (Risk Commission, 1997) have also advocated a default assumption of additivity. As currently practiced, risk assessments of chemical mixtures generally sum cancer risks regardless of tumor type and sum noncancer hazard indices regardless of toxic endpoint or mode of action.

In summary, these and other assumptions contribute to the overall uncertainty in the development of RBSLs. However, given that the largest sources of uncertainty generally result in overestimates of exposure or risk, it is believed that results presented in this document are based on conservative estimates.

#### **4.3 SOIL CONDITIONS FOR PROTECTION OF GROUNDWATER**

In addition to the human health exposure evaluation presented in Section 4.2, COPCs in soil were also evaluated for potential impacts to groundwater. COPCs detected in shallow and deeper soils (below 15 feet bgs) were evaluated with respect to a potential threat to groundwater using the groundwater protection screening levels described in Section 3.3.1. Specifically, RWQCB screening criteria for TPH and BTEX compounds and U.S. EPA Region IX SSLs were used as available for COPCs detected in soil at the Site. Metals were not evaluated for such concerns because of their comparative lack of mobility. COPCs with soil concentrations that exceeded available screening levels for the protection of groundwater quality (Appendix A) are described below by Phase area.

- Phase I Area - TCE, PCE, 1,2-DCA, benzene, and toluene were detected in soil at concentrations above their respective screening levels for the protection of groundwater quality (these five COPCs were also detected in groundwater



observed at a depth of 150 feet bgs in this portion of the Site, beneath Buildings 106, 108, and 112).

- Phase IIIa Area – In one sample, IWDP-N at 10 feet bgs (excavation side wall sample), TPH as c10-c20 hydrocarbons and c21-c28 hydrocarbons were detected in soil at concentrations above RWQCB criteria for TPH as diesel (used as a surrogate criterion for c10-c20 hydrocarbons) or TPH as residual fuel (used as a surrogate criterion for c21-c28 hydrocarbons). As described in Section 3.2, soil from this location (referred to as the inert-waste disposal pit) was previously excavated, and soil removal was terminated due to the proximity of the railroad tracks along the south and west sides of the excavation.
- Phase IIIb Area – Benzene, toluene, and xylenes were detected in soil at concentrations above their respective screening levels. Furthermore, TPH as specific carbon ranges were detected in soil at concentrations above RWQCB criteria for TPH as gasoline (used as a surrogate criterion for c5-c10 hydrocarbons, c6-c10 hydrocarbons, and c7-c12 hydrocarbons) and TPH as diesel (used as a surrogate criterion for c10-c20 hydrocarbons and c10-c28 hydrocarbons).
- Phase IV Area – BTEX were detected in soil at concentrations above their respective screening levels. Furthermore, c6-c10 hydrocarbons and Stoddard solvent were detected in soil at concentrations above the surrogate RWQCB criterion for TPH as gasoline and c10-c20 hydrocarbons and c10-c28 hydrocarbons were detected in soil at concentrations above the surrogate RWQCB criterion for TPH as diesel.

Additional COPCs detected in soil for which the initial soil screening levels for the protection of groundwater were not available include 1,2,4-TMB, 1,3,5-TMB, isopropylbenzene, isopropyltoluene, n-butylbenzene, n-propylbenzene, sec-butylbenzene, and PCBs. One or more of these compounds were detected in soil in the Phase I through Phase IV areas.

Following this initial screening, site-specific soil screening levels for the protection of groundwater were developed for the VOCs identified above the initial screening levels or for which such screening levels were not available using a chemical attenuation analysis. Development of these site-specific screening levels was based on the MCL or the California Department of Public Health (DPH) notification level of these chemicals. The site-specific soil screening levels were estimated as a function of depth from the ground surface, based on site lithology, using the Attenuation Factor (AF) method developed by the Los Angeles RWQCB (RWQCB, 1996). The chemical attenuation analyses performed for the selected VOCs and the resulting site-specific soil screening levels are described further in Section 4.3.1 below.

Because PCBs have a significantly higher soil sorption factor than the compounds addressed in the RWQCB's AF method, it is inappropriate to use the AF method to establish soil screening levels for PCBs. Instead, numerical modeling was performed to simulate the fate and transport of PCBs in a one-dimensional soil column in the vadose zone. The analyses

performed for PCBs and the resulting site-specific soil screening levels are described further in Section 4.3.2 below.

Because MCLs or California DPH notification levels are not available for carbon range-specific TPH in groundwater, site-specific soil screening levels for TPH were not established using the AF or modeling methods. Therefore, the initial RWQCB screening criteria for TPH was used as the site-specific soil screening levels for the protection of groundwater (RWQCB, 1996).

#### **4.3.1 Site-specific Screening of Selected Volatile Organic Compounds in Soil for Protection of Groundwater**

As described above, the site-specific soil screening levels for the protection of groundwater for selected VOCs were estimated following the procedures based on the AF method described in the Los Angeles RWQCB guidance (RWQCB, 1996). The lithologic profile, classified as a mixture of gravel, sand, silt, and clay, was based on the logs of borings 125 and 126, advanced to groundwater at the Site (approximately 150 feet bgs) by Geomatrix. Because similar lithology has been encountered throughout the Site as described in Section 2.3.2.1, the lithologic profile developed from these two borings was considered representative of site-wide conditions. The calculations were implemented in Mathcad® (Parametric Technology Corporation, 2007) worksheets and are presented in Appendix D with the depth-specific screening levels summarized in Table 21.

Several soil concentrations of VOCs (Appendix A) were identified as exceeding the estimated site/depth-specific soil screening levels for the protection of groundwater. Specifically, VOCs in the following Phase areas were detected at concentrations in soil above their respective depth-specific screening levels.

- Phase I Area – TCE, PCE, 1,2-DCA, benzene, and toluene
- Phase IIIb area – Benzene
- Phase IV Area – BTEX

#### **4.3.2 Site-specific Screening of PCBs in Soil and Concrete for Protection of Groundwater**

PCBs in soil and concrete were evaluated for potential impacts to groundwater using a numerical modeling method based on the MCL of these chemicals. The modeling approach and results are summarized below. A more detailed description of the model construction, input parameters, and resulting calculations is provided in Appendix D.

Numerical modeling was performed using the commercial software MODFLOW-SURFACT developed by HydroGeologic, Inc. (HydroGeologic, Inc., 2006). This code is based on the

most commonly used groundwater modeling software, MODFLOW (Harbaugh et al., 2000), with an additional capability to simulate the vadose zone using the Van Genuchten model. MODFLOW-SURFACT is similar to the one-dimensional vadose zone transport model, VLEACH (Ravi and Johnson, 1994).

Consistent with the modeling of VOCs described in Section 4.3.1 above, the lithologic profile used in the PCB modeling was also based on the logs of on-Site borings 125 and 126. Thirty 5-foot-thick soil layers were used to represent the 150-foot-thick vadose zone and a 50-foot-thick layer at the bottom was used to represent the saturated zone in the model. For each boring log, the percentages of gravel, sand, silt, and clay in each model layer were computed by averaging the percentages at the two boring locations. The hydrogeologic parameters and Van Genuchten's model parameters were estimated using the computer code ROSETTA developed by the Salinity Laboratory of the United States Department of Agriculture (U.S. Salinity Laboratory, 2000).

MODFLOW-SURFACT was then used to estimate site-specific attenuation factors for PCBs at various source depths in soil. Specifically, attenuation factors for PCBs at hypothetical source depths of 15 feet, 30 feet, and 45 feet bgs were estimated by simulating the movement of PCBs in pore water from these depths to pore water immediately above the water table (at approximately 150 feet) after 500 years. The attenuation factors calculated with this method ranged from  $2.2 \times 10^{44}$  to  $1 \times 10^{46}$  for the three source depths. These attenuation factors were then used in a reverse calculation from the MCL, 0.5 µg/L, to estimate the source pore water concentrations at 15 feet, 30 feet, and 45 feet bgs that would be necessary to pose a potential threat to groundwater quality. The estimated source pore water concentrations ranged from  $1.1 \times 10^{41}$  mg/L to  $5 \times 10^{42}$  mg/L. Based on these calculations, the concentration of PCBs (as total Aroclors) in source pore water at the Site would need to exceed  $1.1 \times 10^{41}$  mg/L at 45 feet bgs or  $5 \times 10^{42}$  mg/L at 15 to 30 feet bgs to result in groundwater concentrations exceeding the MCL. Because these concentrations greatly exceed the solubility limit of PCBs in water (0.7 mg/L; U.S. EPA, 1996) and exceed the concentration of pure phase PCBs ( $1 \times 10^6$  mg/L), it is physically impossible to achieve total Aroclor concentrations in the source pore water that would result in a concentration of total Aroclors exceeding the MCL in groundwater. Therefore, PCBs in soil at the Site do not pose a potential threat to groundwater at the Site.

Because crushed concrete containing PCBs may be re-used as on-Site fill materials (as restricted and unrestricted use) within the upper 15 feet of the vadose zone, the reverse calculation method described above was also used to verify that PCBs in concrete do not pose a potential threat to groundwater quality. The MODFLOW-SURFACT simulation was performed in the same manner as described above for soil, but modified to account for the physical properties associated with crushed concrete. For crushed concrete, gravel

(approximating the properties for crushed concrete) was used for the hydrogeologic parameters and Van Genuchten's model parameters rather than the lithologic parameters estimated for the upper 15 feet of the soil column. Assuming a source depth of 15 feet bgs (corresponding to the bottom depth of proposed concrete re-use), an attenuation factor of  $1 \times 10^{46}$  was estimated, which is equal to the attenuation factor estimated for PCBs in native soil at 15 or 30 feet bgs. Correspondingly, the source pore water concentration of total Aroclors dissolved from crushed concrete at 15 feet bgs would need to exceed  $5 \times 10^{42}$  mg/L to result in groundwater concentrations exceeding the MCL. This source pore water concentration greatly exceeds the solubility limit of PCBs in water (0.7 mg/L; U.S. EPA, 1996) and exceeds the concentration of pure phase PCBs ( $1 \times 10^6$  mg/L). As such, it is physically impossible for this source pore water to exhibit a total Aroclor concentration exceeding the MCL in groundwater. Therefore, PCBs in concrete that may be re-used as on-Site (restricted and unrestricted) fill materials also do not pose a potential threat to groundwater at the Site.

As confirmation of the modeling results presented above, the PCB attenuation model was run using a forward simulation approach. The model was re-run using the modeling parameters noted above for PCBs in soil at depths of 15, 30 and 45 feet bgs (Figure 11) and crushed concrete at a depth of 15 feet bgs (Figure 12). At all three depths, the modeled PCB concentrations in soil were reduced to non-detect levels at a shallow depth regardless of the duration. A similar outcome was obtained for the modeled PCB concentrations in crushed concrete at a depth of 15 feet bgs.

Also, to address concerns regarding potential colloid-facilitated transport or cosolvency effects, sensitivity analysis simulations were performed where the retardation factor for PCBs was reduced by one order of magnitude (i.e., 10 percent of the value). The simulated concentration profiles over time for PCBs in soil at depths of 15, 30, and 45 feet bgs and crush concrete at a depth of 15 feet are shown on Figures 11 and 12. Although changing the retardation rate increased the migration rate of PCBs through the soil column, the resulting increased migration rate was not fast enough to cause an impact to groundwater.

Neither the sensitivity analysis nor the forward simulation modeling results changed the conclusions presented above. Therefore, PCBs in soil that will remain in place below a depth of 15 feet bgs or in crushed concrete used for backfill that contains PCBs below the remediation goal (at concentrations between 1 mg/kg and 3.5 mg/kg) do not pose a potential threat to groundwater at the Site.

## 5.0 REMEDIATION OBJECTIVES AND SCENARIOS FOR FS EVALUATION

Based on the results of the screening risk assessment [NCP 40 CFR 300.430(d)(4)], this section describes the RAOs, COCs developed from COPCs, site-specific risk-based and other

remediation goals (referred to herein as site-specific remediation goals) for the COCs, and areas of the Site where the COC concentrations in soil, soil vapor, and concrete are above the site-specific remediation goals.

## **5.1 REMEDIAL ACTION OBJECTIVES**

RAOs are general risk management goals for protecting human health and the environment. The RAOs for the Site are listed below.

- Mitigate shallow soil vapor impacted with COCs above site-specific remediation goals established for future Site use for the protection of commercial/industrial workers occupying buildings that may be affected by vapor intrusion.
- Mitigate shallow soil impacted with COCs above the site-specific remediation goals established for future Site use of soils to a depth of 15 feet for the protection of future construction workers or some future commercial/industrial Site workers.
- Mitigate PCB-impacted concrete for the protection of human health.
- Mitigate deeper soils (depths greater than 15 feet) impacted with COCs at concentrations above the site-specific remediation goals established for the protection of groundwater and to support monitored natural attenuation of VOCs detected in groundwater beneath the Site.

To meet the RAOs for the Site, site-specific remediation goals were established, and COC-impacted areas were identified as discussed in the following sections. In addition, future site uses are proposed to be restricted pursuant to a land use covenant (i.e., prohibit residential development and use of groundwater from the first water-bearing unit within the site perimeter).

## **5.2 SITE-SPECIFIC REMEDIATION GOALS**

Based on the results of the screening-level HHRA for COPCs present in soil, concrete, groundwater, and soil vapor (Section 4.2), and an evaluation of soil and concrete conditions for the protection of groundwater (Section 4.3), several COCs were identified that require mitigation. In shallow soil (upper 15 feet of the vadose zone), arsenic, chromium, cobalt, PCBs, and TPH in soil were identified as key chemicals contributing significantly to potential risk or hazards in certain Phase areas of the Site (Section 4.2.3.1). As further discussed in Section 5.2.2.3, arsenic, PCBs, and TPH were identified as COCs in soil. PCBs were also identified as COCs in concrete building slabs for the proposed reuse of the crushed concrete as fill material in the upper 15 feet of the vadose zone. VOCs were identified as COCs in groundwater based on concentrations that exceed MCLs. Finally, VOCs were also identified as COCs in soil vapor with the potential to pose future vapor intrusion risks at the Site. A

summary of the COCs requiring mitigation and the site-specific remediation goals developed for the COCs are described in the subsections below.

Because future use of the Site will be commercial/industrial (not residential), a cumulative target cancer risk level of  $10^{-5}$  is proposed and was used in the development of remediation goals protective of potential cancer risks. This target risk level is the mid-point of the risk management range recommended by U.S. EPA ( $10^{-6}$  to  $10^{-4}$ ), and is the risk level at or above which notification is required under the Proposition 65 and Air Toxic Hot Spots programs in California (OEHHA, 2001; 2003; and 2004). In addition,  $10^{-5}$  is commonly used as the target risk level for commercial/industrial sites overseen by DTSC with the issuance of a land use covenant. For potential noncarcinogenic effects, a cumulative target HI of 1 was used in the development of remediation goals. Both targets were set as “acceptable” levels for cumulative chemical exposure related to commercial/industrial re-use of the Site with the issuance of a land use covenant, in coordination with the U.S. EPA and DTSC risk management teams responsible for approval of the risk-based application for PCBs and non-PCB COPCs (conference call held with DTSC and U.S. EPA on April 27, 2010).

### 5.2.1 Indoor Air Exposure

Chloroform, PCE, and TCE in shallow soil vapor (5 and 15 feet bgs) in the Phase I area contributed significantly to potential risk or hazards for future indoor commercial/industrial workers. These VOCs did not pose a significant cancer risk or noncancer hazard for future outdoor workers (outdoor commercial/industrial workers or construction workers). These COPCs were therefore only identified as COCs for potential indoor inhalation exposures under future commercial/industrial use. Shallow soil vapor remediation goals were established for these three COCs to mitigate potential exposures to a future indoor commercial/industrial worker (applicable to soil vapor within 15 feet bgs). Using the cancer-based RBSLs protective of a  $10^{-6}$  risk of indoor commercial/industrial worker exposure (2.0 µg/L, 2.2 µg/L, and 6.3 µg/L for chloroform, PCE, and TCE, respectively [Table 3]), remediation goals were derived protective of one-in-one hundred thousand ( $10^{-5}$ ) risk from cumulative exposure to these VOCs (6.7 µg/L, 7.3 µg/L, and 21 µg/L, respectively).

Remediation goals were also derived for chloroform, PCE, and TCE in shallow soil vapor using the noncancer-based RBSLs protective of a chemical-specific, noncancer HQ of 1 (1100 µg/L, 170 µg/L, and 2700 µg/L for chloroform, PCE, and TCE, respectively [Table 3]). These remediation goals were derived to be protective of a cumulative HI of 1 (367 µg/L, 56.7 µg/L, and 900 µg/L for chloroform, PCE, and TCE, respectively). Because the remediation goals derived from the cancer-based RBSLs are universally more conservative, these values were established as the final remediation goals for these VOCs under future commercial/industrial use as summarized in Table 22. Chloroform, PCE, and TCE are at concentrations in shallow



soil vapor that exceed these remediation goals at the northern portion of Buildings 106, 108, and 112 (Figure 13).

TPH as Stoddard solvent, 1,2,4-TMB, and 1,3,5-TMB in shallow soil vapor (5 and 15 feet bgs) in the Phase IIIb and Phase IV areas contributed significantly to potential hazards for future indoor commercial/industrial workers. These VOCs did not pose a significant noncancer hazard for future outdoor workers (outdoor commercial/industrial workers or construction workers). Although specific redevelopment plans for either area have not been proposed, these COPCs were identified as COCs for potential indoor inhalation exposures assuming future commercial/industrial use. Shallow soil vapor remediation goals were established for these three COCs to mitigate potential exposures to a future indoor commercial/industrial worker (applicable to soil vapor within 15 feet bgs) using the noncancer-based RBSLs protective of a chemical-specific noncancer HQ of 1 (1500 µg/L, 37 µg/L, and 32 µg/L for TPH as Stoddard solvent, 1,2,4-TMB, and 1,3,5-TMB, respectively [Table 3]). These remediation goals were derived protective of a cumulative HI of 1 (500 µg/L, 12.3 µg/L, and 10.7 µg/L for TPH as Stoddard solvent, 1,2,4-TMB, and 1,3,5-TMB, respectively). These values were established as the final remediation goals for these VOCs under future commercial/industrial use as summarized in Table 22. TPH as Stoddard solvent, 1,2,4-TMB, and 1,3,5-TMB are at concentrations in shallow soil vapor that exceed remediation goals near the former Stoddard solvent USTs area, the former tube mill Stoddard solvent dip tanks and vault area, and the former tube mill and roll stretcher machine area (Figure 13).

1,2-DCA and TCE were identified as key COPCs for potential vapor intrusion risks from groundwater at a depth of 150 feet bgs for commercial/industrial workers (Table 12), but were not identified as COCs for this pathway. Cumulative cancer risks for the pathway were below  $10^{-5}$ , the target risk level proposed for commercial/industrial use of the Site. Furthermore, vapor intrusion risks evaluated using shallow soil vapor data are more significant, with chloroform, PCE, TCE, TPH as Stoddard solvent, 1,2,4-TMB, and 1,3,5-TMB identified as COCs in soil vapor for this pathway. This difference is likely due to the presence of a fine-grained unit at approximately 50 feet bgs and potential source areas related to these COCs. An applicable remedy will be proposed to mitigate these potential vapor intrusion risks.

### 5.2.2 Direct Contact Exposure

Site-specific remediation goals were established for PCBs and arsenic in shallow soil (0 to 15 feet bgs) to mitigate potential direct contact exposures to future workers. Specifically, remediation goals were developed to mitigate potential exposures to construction workers involved with future construction at the Site as well as to workers under future commercial/industrial use of the Site. Sections 5.2.2.1 and 5.2.2.2 describe the site-specific remediation goals derived for PCBs and arsenic, respectively. Section 5.2.2.3 explains why



direct contact exposure-based remediation goals were not derived for chromium, cobalt, and TPH compounds.

#### **5.2.2.1 Site-Specific Remediation Goals for PCBs**

As presented in Tables 4 through 10, the estimated cancer risks for outdoor commercial/industrial worker exposure to the Aroclor mixtures detected in soil (Aroclor-1016, -1232, -1248, -1254, and -1260) are greater than the predicted risks for construction worker exposure to these compounds. Therefore, soil remediation to mitigate potential outdoor commercial/industrial worker exposure to these Aroclor mixtures would also mitigate potential construction worker exposure. Similarly, remediation of concrete proposed for re-use at the site as potential fill materials would mitigate both potential outdoor commercial/industrial worker exposure and construction worker exposure to carcinogenic PCBs in concrete. However, the potential exposure to future outdoor commercial/industrial workers would only occur if PCB-impacted soil or concrete is left exposed at the land surface at the Site. To mitigate potential exposures to PCB-impacted soil, two risk-based remediation goals for PCBs (as total Aroclors) were developed and initially presented in the PCBNP (AMEC, 2009); one for soil that may be left exposed at the surface (protective of both potential outdoor commercial/industrial worker exposure and construction worker exposure), and another for subsurface soil that only construction workers may come into contact with during excavation, grading, etc. (and would remain in the subsurface following such activities). These two remediation goals as initially proposed are described briefly below.

- A PCB remediation goal of 5.3 mg/kg (total Aroclors) was proposed for soil that may be left exposed at the surface (0 to 5 feet bgs). This goal is based on the cancer-based RBSL of 0.53 mg/kg for outdoor commercial/industrial worker exposure to PCBs in soil, adjusted to a  $10^{-5}$  risk level (Table 1).
- A PCB remediation goal of 35 mg/kg (total Aroclors) was proposed for subsurface soil (at 5 to 15 feet bgs) that only construction workers may come into contact with during excavation, grading, etc. and that would remain below pavement (or 5 feet below crushed concrete containing less than 5.3 mg/kg). This goal is based on the cancer-based RBSL of 3.5 mg/kg for construction worker exposure to PCBs in soil, adjusted to a  $10^{-5}$  risk level (Table 1).

These remediation goals are consistent with the remediation goals established for commercial/industrial worker exposures to COCs in soil vapor that are also protective of a cumulative target cancer risk level of  $10^{-5}$ . The noncancer-based RBSL developed for construction worker exposure to Aroclor-1254, 2.0 mg/kg (Table 1), was proposed as an additional soil remediation goal specifically for this Aroclor mixture that is protective of a chemical-specific, noncancer HQ of 1 (AMEC, 2009). Given the relative magnitude of the construction worker noncancer-based RBSL to the outdoor commercial/industrial worker noncancer-based RBSL (2.0 mg/kg versus 7.5 mg/kg, respectively) (Table 1), mitigation of noncancer hazards to construction workers

from exposure to Aroclor-1254 would also mitigate noncancer hazards to outdoor commercial/industrial workers. Finally, for concrete that may be demolished on-Site, crushed, and reused as fill in soil and foundation removal areas, the total PCB remediation goal of 5.3 mg/kg for surface soil was proposed as the remediation goal for potential exposure to PCBs in concrete (AMEC, 2009). Applying this remediation goal would also ensure that the waste criteria for concrete containing PCBs would also be met [i.e., less than 50 mg/kg, as defined in 40 CFR Section 761.61(a)(4)(i)(A)].

As part of the U.S. EPA's conditional approval (U.S. EPA, 2010a) of the PCBNP, the U.S. EPA deferred approval of the proposed remediation goals until Pechiney could demonstrate that dioxin-like PCB congeners, if present in on-Site concrete and/or soil, do not increase the cumulative cancer risk for the Site above  $1 \times 10^{-5}$ . If this risk level were exceeded, it was required that Pechiney propose cleanup levels for PCBs in concrete and soil that are adequately protective and do not pose a risk of injury to health or the environment. Based on this requirement, additional sampling (outlined in Section 2.2 of the SAP [AMEC, 2010]) was conducted in September and October, 2010, and the sampling results were evaluated for potential human health concerns. Nine concrete samples and 17 soil samples were collected and "split" for analysis by U.S. EPA Method 8082 for PCBs as Aroclor mixtures and analysis by U.S. EPA Method 1668B for individual "dioxin-like" PCB congeners.<sup>3</sup> The samples selected for both analyses were collected from areas where total Aroclors were reported from previous rounds of sampling at high, medium, and low concentrations with respect to the proposed 5.3 mg/kg risk-based remediation goal, with the majority of the samples intentionally collected from locations where total Aroclor concentrations were just below the remediation goal (within one order of magnitude). Specific information regarding the targeted sample locations and sampling procedures is provided in the SAP (AMEC, 2010). The intent of the targeted sampling was to provide coverage across a range of concentrations so that potential correlations between PCBs as Aroclors and the dioxin-like PCB congeners could be evaluated.

Two separate evaluations were then conducted with the pairs of dioxin-like PCB congener and Aroclor mixture data from the 2010 concrete and soil samples to determine if dioxin-like PCB congeners present a more significant human health risk than PCBs as Aroclors, and if the proposed risk-based remediation goals for the Site based on total Aroclor concentrations would be adequately protective for dioxin-like PCB congeners. These two evaluations are discussed below.

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<sup>3</sup> Concrete samples were split by first milling each sample to a powder/fine granular mixture, then homogenizing the sample, then dividing the sample into two aliquots. Soil samples were split by manually (mechanically) blending each sample and then dividing into two aliquots.

### Regression Analyses of Dioxin TEQ versus Total Aroclors

Regression analyses were performed with the pairs of dioxin-like PCB congener and Aroclor mixture data to evaluate the potential significance of the relationship between these measurements and determine whether the proposed risk-based remediation goals are adequately protective of potential PCB exposures. Potential correlations were evaluated between the dioxin-like PCB congeners expressed as dioxin toxic equivalent (TEQ) and the Aroclor mixture data expressed as total Aroclor concentrations. Dioxin TEQ concentrations were calculated for each sample using the toxic equivalency factors (TEFs) developed by the World Health Organization (WHO) in 2005 (Van den Berg, M. et al., 2006). Where the concentration of an individual dioxin-like PCB congener was reported as not detected, one half of the detection limit was used as a surrogate to calculate the contribution to dioxin TEQ concentrations from that congener. Of the two commonly used approaches to calculating a dioxin TEQ,<sup>4</sup> using one half of the detection limit for non-detect results was considered appropriate for the 2010 concrete and soil data given that all 12 dioxin-like PCB congeners were detected at least once in both data sets, thus providing evidence that all 12 congeners were present at the Site. Dioxin TEQ concentrations for PCB congeners ranged from 2.81 to 14,250 picograms per gram (pg/g) in concrete and 0.14 to 573 pg/g in soil (TEQ concentrations are presented in the data tables in Appendix A). For consistency with the treatment of non-detect congeners in the estimation of dioxin TEQ, one half of the reporting limit for non-detect Aroclor mixtures was used in the calculation of total Aroclors, with results for Aroclor-1016, -1232, -1248, -1254, and -1260 factoring into the total Aroclor concentration calculations (i.e., the Aroclor mixtures that were detected at least once in the concrete and soil samples combined).

Details of the regression analyses are presented in Appendix E. Separate regression analyses were performed for the concrete samples, soil samples, and concrete and soil samples combined, with the relative strength of each regression evaluated. As presented in Appendix E, the “strongest” regression was the regression using the untransformed combined soil and concrete data. This regression identifies a concentration of total Aroclors at a risk-based remediation goal equivalent for dioxin TEQ (81 pg/g) that is less than the originally proposed risk-based remediation goal of 5.3 mg/kg for concrete and soil that may be left exposed at the surface (0 to 5 feet bgs). Specifically, the total Aroclor concentration corresponding to 81 pg/g dioxin TEQ on the regression line is approximately 3.5 mg/kg. As a result, a revised risk-based remediation goal for PCBs (as total Aroclors) of 3.5 mg/kg for concrete and soil that may be left exposed at the surface (0 to 5 feet bgs) would be adequately protective of PCBs as dioxin-like congeners. To determine if the originally proposed risk-

<sup>4</sup> The alternative approach to calculating dioxin TEQ is to assume that non-detect congeners are not present and thus contribute zero to dioxin TEQ concentrations.

based remediation goal for PCBs (as total Aroclors) for deeper soil (between 5 and 15 feet bgs) of 35 mg/kg would be adequately protective, the results of the regression for the combined soil and concrete data (untransformed) were also plotted against this remediation goal along with the equivalent risk-based remediation goal for dioxin-like PCB congeners, 530 pg/g TEQ.<sup>5</sup> As shown in Appendix E (Figure E-3), the regression using the combined soil and concrete data (untransformed) identifies a concentration of total Aroclors at a risk-based remediation goal equivalent for dioxin TEQ (530 pg/g) that is less than 35 mg/kg. As a result, a revised risk-based remediation goal for PCBs (as total Aroclors) of 23 mg/kg for deeper soil (between 5 and 15 feet bgs) would be adequately protective of PCBs as dioxin-like congeners.

#### Human Health Risk Calculations for Dioxin-like PCB Congeners and Aroclor Mixtures

Potential human health risks associated with the dioxin-like PCB congener and Aroclor mixture data from the 2010 concrete and soil samples were also comparatively estimated to further assess the need to revise the proposed risk-based remediation goals based on Aroclor mixtures. Hypothetical, representative exposure point concentrations (EPCs) were calculated for the 12 dioxin-like PCB congeners and five Aroclor mixtures detected in the 2010 concrete and soil characterization samples. For the dioxin-like PCB congeners, EPCs were calculated for the individual congeners as well as for dioxin TEQ. For this evaluation, EPCs were calculated for the concrete and soil data combined, assuming that exposure of future workers is potentially complete for both media (i.e., assuming concrete building slabs may be demolished on-Site, crushed, and intermixed with soil for reuse in removal areas). U.S. EPA's ProUCL product (U.S. EPA, 2010b) was used to determine upper confidence limit of the mean EPCs for dioxin TEQ, each dioxin-like PCB congener, and each Aroclor mixture. The resulting ProUCL output is provided in Appendix F.

Potential human health risks from exposure to PCBs were then estimated by quantitatively comparing the resulting EPCs to the RBSLs presented in Section 4.2.2 and Table 1. To streamline the evaluation, EPCs were only compared to the lowest of available RBSLs, the cancer-based RBSLs for outdoor commercial/industrial workers. Comparing the EPCs to these RBSLs would provide a conservative estimate of potential human health risks from exposure to PCBs as dioxin-like congeners versus PCBs as Aroclors. Predicted lifetime excess cancer risks were calculated for outdoor commercial/industrial workers by dividing each EPC by the appropriate cancer-based RBSL, and then multiplying these risk ratios by the target risk level used in the development of the RBSLs (i.e., one-in-one million or  $1 \times 10^{-6}$ ). Risks from exposure to dioxin-like PCB congeners were then comparatively evaluated to risks from exposure to the Aroclor mixtures.

<sup>5</sup> Based on the carcinogenic RBSL for dioxin-like PCB congeners for construction workers (53 pg/g TEQ), adjusted to a target cancer risk of  $10^{-5}$ .

The results of the analysis are presented in Table 23. As presented, the predicted lifetime excess cancer risk for outdoor commercial/industrial worker exposure to dioxin-like PCB congeners is  $2 \times 10^{-4}$  based on EPCs for each of the individual congeners, but  $8 \times 10^{-4}$  based on dioxin TEQ. The difference in these risk estimates can be attributed to the influence of elevated detection limits in the sample-specific calculations of dioxin TEQ. By comparison, the predicted lifetime excess cancer risk for outdoor commercial/industrial worker exposure to Aroclor mixtures is  $5 \times 10^{-4}$ . As a result, it would appear that, on average, the dioxin-like PCB congeners do not pose a more significant human health risk than PCBs evaluated as Aroclor mixtures, but on a sample-by-sample basis (as dioxin TEQ), the congeners present a slightly more significant human health risk than PCBs evaluated as Aroclor mixtures. These results are consistent with the results of the regression analyses. Given that the potential human health risks from dioxin-like PCB congeners as dioxin TEQ are slightly more significant than the potential human health risks from total Aroclors, a slight reduction of the risk-based remediation goals for PCBs as total Aroclors (as illustrated by the regression analyses) would be necessary to be adequately protective of PCBs as dioxin-like congeners.

#### Summary of Revised PCB Remediation Goals

Based on the above evaluations, the revised PCB (as total Aroclor) remediation goals proposed for the Site are summarized below. These goals were conditionally approved by U.S. EPA on July 1, 2011.

##### 1. Proposed Remediation Goals for PCBs in Concrete

- **Total Aroclors – 3.5 mg/kg.** Based on the regression analysis for dioxin-like PCB congeners versus total Aroclors in combined soil and concrete, the total Aroclor concentration that would result in a maximum dioxin TEQ concentration of 81 pg/g.

##### 2. Proposed Remediation Goals for PCBs in Shallow Soil (0 to 15 feet bgs)

- **Aroclor-1254 – 2.0 mg/kg.** For soil between 0 and 15 feet bgs. Based on the noncancer RBSL for construction workers and a target noncancer HI of 1.
- **Total Aroclors – 3.5 mg/kg.** For soil that may be left exposed at the surface (0 to 5 feet bgs). Based on the regression analysis for dioxin-like PCB congeners versus total Aroclors in combined soil and concrete, the total Aroclor concentration that would result in a maximum dioxin TEQ concentration of 81 pg/g.
- **Total Aroclors – 23 mg/kg.** For subsurface soil (5 to 15 feet bgs) that only construction workers may come into contact with during excavation, grading,

etc. (and that would remain at 5 to 15 feet bgs). Based on the regression analysis for dioxin-like PCB congeners versus total Aroclors in combined soil and concrete, the total Aroclor concentration that would result in a maximum dioxin TEQ concentration of 530 pg/g.

All site-specific remediation goals for PCBs are also summarized in Table 24, with explanations provided for how each value was established.

#### **5.2.2.2 Site-Specific Remediation Goal for Arsenic**

For arsenic, a remediation goal corresponding to the site-specific background concentration of 10 mg/kg was used to mitigate potential outdoor commercial/industrial worker and construction worker exposures to this COC (Table 24). Although the site-specific background concentration is above the cancer-based RBSLs for outdoor commercial/industrial worker or construction worker exposure, remediation of soil to levels below background is not typically required by U.S. EPA (U.S. EPA, 2004) or DTSC (DTSC, 1997).

#### **5.2.2.3 Other Key Chemicals**

Chromium was identified as a key chemical for hypothetical future construction worker exposure in the Phase II area (Table 5), but was not identified as a COC. Chromium contributed a cancer risk level of  $3.8 \times 10^{-6}$  for the construction worker scenario, but no other carcinogenic COPCs (i.e., PCBs) were detected in the vicinity of the maximum detected concentration used in the screening (from boring H-1, 5 feet bgs; Appendix A). Provided the PCB-impacted areas of the Phase II area are remediated, the residual risk would be below the proposed cumulative target cancer risk level of  $10^{-5}$ . All remaining detected concentrations of chromium at the Site were below site-specific background (25 mg/kg).

Cobalt was identified as a key chemical for hypothetical future construction worker exposure in the Phase IV area (Table 8), contributing a cancer risk level of  $1.4 \times 10^{-6}$  and a noncancer HQ of 2, but was not identified as a COC. The maximum detected concentration used in the screening, 16 mg/kg (from boring SWC-3B at 15 feet bgs; Appendix A) is just above site-specific background (14.1 mg/kg), with all remaining detected concentrations below the background level. On average, the cobalt concentrations at the Site are consistent with background.

TPH as c6-c10 hydrocarbons was identified as a key chemical for hypothetical future construction worker exposure in the Phase IIIb and Phase IV areas. Under worst-case assumptions (using worst-case RBSLs), TPH as c10-c20 hydrocarbons would also be identified as a key chemical for hypothetical future construction worker exposure in the Phase IIIa area (Table 6); TPH as c10-c28 hydrocarbons would also be identified as a key chemical



for hypothetical future construction worker exposure in the Phase IIIb area (Table 7); and TPH as c10-c20 hydrocarbons and TPH as c10-c28 hydrocarbons would also be identified as key chemicals for hypothetical future construction worker exposure in the Phase IV area (Table 8). However, risk-based remediation goals were not developed for these TPH compounds from their respective noncancer-based RBSLs. The site-specific soil screening levels for the protection of groundwater for these compounds, 500 mg/kg (for TPH as c6-c10 hydrocarbons) and 1000 mg/kg (for TPH as c10-c20 hydrocarbons and TPH as c10-c28 hydrocarbons, respectively), are lower than their respective noncancer-based RBSLs for construction worker exposure, 6900 mg/kg and 33,000 mg/kg (or 2900 mg/kg and 6600 mg/kg, the worst-case RBSLs; Table 1). Thus, any remediation proposed for these compounds to meet RAOs for the protection of groundwater, as described in Section 5.2.3 below, would also meet the RAOs for the protection of future construction worker exposures.

#### **5.2.2.4 Areas where Arsenic and/or PCBs in Soil Exceed Remediation Goals**

The specific areas where arsenic and/or PCBs in soil are at concentrations that exceed the remediation goals established for the Site in the upper 15 feet of the vadose zone are as follows (Figure 13).

- Phase I Area – PCBs in soil and gravel fill adjacent to a former transformer located outside of Building 106 (along the east side of the building), and at isolated sub-slab sample locations between former Buildings 106 and 108.
- Phase II Area – PCBs in soil near the location of the saw and near the former buried vertical pit and near storm water outfall #7.
- Phase IIIa Area – Arsenic and PCBs in soil near the location of the cooling tower hot well, arsenic and PCBs in soil near storm water outfall #6, and PCBs (Aroclor-1254) in soil near the north and west sides of the former waste disposal pit.
- Phase IV Area – Arsenic and PCBs in soil near the former scalper/planer machine area.
- Phase VI Area – Arsenic in surface soil near the buried rail line.

#### **5.2.3 Potential Beneficial Use of Groundwater**

Groundwater in the first-water-bearing unit is not used for domestic water supply, but because the RWQCB has designated groundwater in the site vicinity for beneficial use, State and Federal MCLs were used to evaluate COPCs in groundwater. Five VOCs, including benzene, chloroform, 1,2-DCA, dichloromethane (i.e., methylene chloride), and TCE, were detected at concentrations above their respective MCLs. The specific areas where these VOCs are at concentrations above MCLs are as follows:



- Phase I Area – Benzene, 1,2-DCA, and TCE in groundwater samples collected from soil borings (using a hydropunch method) in the northwest portion of the site, within the footprint of Building 106.
- Phase IIIa Area – Chloroform, 1,2-DCA, and TCE in groundwater monitoring well samples collected from former well AOW-7.
- Phase IIIb Area – Chloroform, 1,2-DCA, and/or TCE in groundwater monitoring well samples collected west of Building 112A in the vicinity of the Stoddard solvent USTs at monitoring well AOW-8 and former monitoring well AOW-3.
- Phase IV Area – 1,2-DCA in groundwater monitoring well samples collected from well AOW-9.
- Phase VI Area – Dichloromethane (i.e., methylene chloride) and/or TCE in groundwater monitoring well samples collected from former well AOW-1.

These VOCs were subsequently identified as COCs, but site-specific remediation goals were not established. The concentrations of these compounds in groundwater beneath the northern portion of the Site will likely decrease over time by mitigating VOC-impacted soil in the Phase I area and implementing a monitored natural attenuation (MNA) program for these COCs in groundwater. The MNA approach is proposed for the Site for the following reasons:

- presence of low concentrations of chlorinated VOCs, with the concentration of TCE ranging between 3 µg/L and 420 µg/L in groundwater samples collected beneath the Site;
- depth at which groundwater was observed (about 150 feet below grade) limits potential exposure to TCE and other VOCs by inhalation through potential vapor intrusion or dermal contact with groundwater;
- observed reduction (attenuation) in chlorinated VOC concentrations in groundwater samples collected in the southern portion of the Site since 1991 (wells AOW-3, AOW-7, AOW-8 and AOW-9);
- remediation proposed for an on-Site source of chlorinated VOCs in the northwestern portion of the Site (source removal);
- the presence of other source(s) of TCE in groundwater in the Site vicinity (regional impacts); and
- issuance of a land use covenant to restrict the use of on-Site groundwater within the first water-bearing unit.

#### **5.2.4 Potential Impacts to Groundwater**

Several VOCs in soil, specifically TCE, PCE, 1,2-DCA, and BTEX, were identified as exceeding site-specific soil screening levels for the protection of groundwater as described in

Section 4.3.1. All of these COPCs were subsequently identified as COCs, and the site-specific soil screening levels for these compounds were established as remediation goals to mitigate a potential future risk to groundwater. A summary of the remediation goals is provided in Table 25. The RWQCB screening levels for groundwater protection for TPH in soil were also established as remediation goals for the various TPH fractions and constituents identified as above these criteria in Section 4.3. These remediation goals are summarized in Table 24. The specific areas and depths where the identified VOCs and TPH are at concentrations that exceed the remediation goals are as follows (Figure 13):

- Phase I area – TCE and PCE detected at depths between 21.5 and 136 feet bgs in soil in northern portion of Buildings 106, 108, and 112. Benzene and toluene detected at depths between 50.5 and 140 feet bgs in soil in the southern portion of Building 106. 1,2-DCA detected at depths between 50.5 and 80.5 feet bgs in soil in the southern portion of Building 106.
- Phase IIIa area – TPH as c10-c20 hydrocarbons and c21-c28 hydrocarbons detected at 10 feet bgs at the north end of the former waste disposal pit.
- Phase IIIb area – Benzene, Stoddard solvent compounds as TPH (specific carbon ranges of c5-c10, c6-c10, c7-c12, and other TPH compounds [c10-c20, c10-c28, and c21-c28]) detected at depths between 10 and 45 feet bgs in soil in the area of the former Stoddard solvent USTs.
- Phase IV Area – Stoddard solvent compounds as TPH (specific carbon ranges of c6-c10), BTEX compounds, and TPH (specific carbon ranges of c10-c20 and c10-c28) detected in the locations of the former tube mill and roll stretcher machine, the scalper/planer machine, and former tube mill Stoddard solvent dip tanks and vault areas in soil at depths between 1 and 58.5 feet bgs.

### 5.2.5 Summary of Site-specific Remediation Goals

As described in Sections 5.2.1 through 5.2.3 above, various site-specific remediation goals were established for COCs in soil vapor, soil, and concrete at the Site under various future land use scenarios (e.g. commercial/industrial land use). These site-specific remediation goals are also summarized in Tables 22, 24, and 25, with explanations provided for how each value was established. In summary, the site-specific remediation goals established for such scenarios are as follows:

Remediation Goals Established for COCs in Shallow Soil Vapor – for potential future commercial/industrial indoor air exposure (Table 22).

#### 1. VOCs in Shallow Soil Vapor (at 5 and 15 feet bgs):

- Chloroform – **6.7 µg/L;**
- PCE – **7.3 µg/L;**

- TCE – **21 µg/L**;
- TPH as Stoddard solvent – **500 µg/L**;
- 1,2,4-TMB – **12.3 µg/L**; and
- 1,3,5-TMB – **10.7 µg/L**.

Remediation Goals Established for COCs in Soil and Concrete – for future commercial/industrial use scenarios (Table 24).

2. PCBs in Shallow Soil (surface to 15 feet bgs):

- Aroclor-1254 – **2.0 mg/kg**;
- Total Aroclors – **3.5 mg/kg** for soil that may be left exposed at the surface (0 to 5 feet bgs); and
- Total Aroclors - **23 mg/kg** for subsurface soil (5 to 15 feet bgs) that only construction workers may come into contact with during excavation, grading, etc. (and that would remain at 5 to 15 feet bgs).

3. PCBs in Concrete:

- Total Aroclors – **3.5 mg/kg**.

4. Metals in Shallow Soil (0 to 15 feet bgs):

- Arsenic – **10 mg/kg**.

5. TPH in Shallow and Deeper Soil (surface to groundwater, at approximately 150 feet bgs):

- c5-c10 hydrocarbons, c6-c10 hydrocarbons, c7-c12 hydrocarbons, and TPH as Stoddard solvent – **500 mg/kg** (gasoline range hydrocarbons);
- c10-c20 hydrocarbons and c10-c28 hydrocarbons – **1000 mg/kg** (diesel range hydrocarbons); and
- c21-c28 hydrocarbons – **10,000 mg/kg** (residual fuel range hydrocarbons).

VOCs in Shallow and Deeper Soil (surface to groundwater, at approximately 150 feet bgs) – depth-specific remediation goals for TCE, PCE, BTEX, and 1,2-DCA are presented in Table 25.

Remediation goals were not established for the COCs identified in groundwater. Monitored natural attenuation of VOCs in groundwater in combination with on-Site vadose zone source remediation is proposed as the remedial approach for groundwater at the Site.

Boring or sample locations with matrix sample concentrations above the site-specific remediation goals are shown on Figure 13.

### **5.3 AREAS WITH COC-IMPACTED SOIL ABOVE THE REMEDIATION GOALS**

Based on previous investigation data and screening risk assessment findings, the following areas within each Phase area were identified with COC-impacted soils having concentrations greater than the applicable site-specific remediation goals described in Section 5.2. These areas will need to be addressed as part of Site closure. The approximate dimensions and in-place soil volumes for each of the areas summarized below are shown on Figure 14.

#### **Phase I Area:**

- Area 1: Northeast portion of former Building 112 where soil is impacted with TCE at concentrations above the site-specific remediation goal for the future protection of groundwater.
- Area 2: Southern portion of former Building 106 where soil is impacted with benzene, 1,2-DCA and TCE at concentrations above the site-specific remediation goals for the future protection of groundwater.
- Area 3: Northwest corner of the Site (former Buildings 106 and 108) where soil, soil vapor, and groundwater are impacted with TCE (and other VOCs). TCE and PCE concentrations in soil are above site-specific remediation goals for the future protection of groundwater. Chloroform, TCE, and PCE are above site-specific remediation goals for potential commercial/industrial indoor air exposure.
- Area 13: West of Building 106 (near former substation #8) where soil and gravel are impacted with PCBs at concentrations above the site-specific remediation goal for the protection of future commercial/industrial workers (i.e., soil from 0 to 5 feet).
- Areas 16a, 16b, and 16c: Northwest portion of the Site (between former Buildings 106 and 108) where sub-slab soil is impacted with PCBs at concentrations above the site-specific remediation goal for the protection of commercial/industrial workers (i.e., soil from 0 to 5 feet).

#### **Phase II Area:**

- Areas 4a and 4b: West-central portion of former Building 104 (near the former vertical pit) where soil is impacted with PCBs at concentrations above the site-specific remediation goals for the protection of future of commercial/industrial workers (i.e., soil from 0 to 5 feet) and future construction workers (i.e., soil from 5 to 15 feet).
- Areas 5a, 5b and 5c: Southern portion of former Building 104 (near the saw location) where soil is impacted with PCBs at concentrations above the site-specific remediation goal for the protection of future commercial/industrial workers (i.e., soil

from 0 to 5 feet). Areas 5a and 5b are located in areas with PCB-impacted concrete.

- Area 15: Near former storm water outfall #7 (west of former Buildings 106 and 104) where soil remains impacted with PCBs at concentrations above the site-specific remediation for the protection of future of commercial/industrial workers (i.e., soil from 0 to 5 feet) and future construction workers (i.e., soil from 5 to 15 feet).

#### Phase IIIa/b Areas:

- Areas 6a and 6b: North side of cooling tower hot well area where soil is impacted with arsenic at a concentration above the site-specific background level for this metal (i.e., the remediation goal) and where soil remains in place at 3 feet and is impacted with PCBs at a concentration above the site-specific remediation goal for the protection of future commercial/industrial workers (i.e., soil from 0 to 5 feet).
- Area 7: Near storm water outfall #6 area where soil is impacted with arsenic and at the north end of the former inert waste disposal pit where soil is impacted with PCBs (Aroclor-1254). The concentration of arsenic is above the site-specific background level for this metal (i.e., the remediation goal). The concentration of Aroclor-1254 is above the site-specific remediation goal for the protection of future commercial/industrial workers and future construction workers.
- Area 14: Along the west side of the former storm water outfall #6 (at the fence line) where soil remains in place at 2 feet and is impacted with PCBs at a concentration above the site-specific remediation goal for the protection of future commercial/industrial workers (i.e., soil from 0 to 5 feet).
- Area 8: Former Stoddard solvent USTs and still area where soil is impacted with Stoddard solvent compounds and benzene at concentrations above the site-specific remediation goals for the protection of groundwater, and TPH (c6-c10 hydrocarbons) at concentrations above the site-specific remediation goal for the protection of groundwater and future construction workers. The area is also impacted with Stoddard solvent and TMBs in soil vapor above site-specific remediation goals for potential commercial/industrial indoor air exposure.

#### Phase IV Area:

- Areas 9a and 9b: Area east and west of the former scalper and planer machines where soil is impacted with arsenic at a concentration above the site-specific background level for this metal (i.e., the remediation goal), and where soil is impacted with TPH above the site-specific remediation goals for the protection of groundwater (Area 9b).
- Area 9c: The location of the scalper/planer machine area where soil is impacted with Stoddard solvent compounds and benzene at concentrations above the site-specific remediation goals for the protection of groundwater (Note: monitoring well AOW-9 located near this area will be protected during proposed remediation activities), and TPH (c6-c10 hydrocarbons and c10-c20 hydrocarbons) at

concentrations above the site-specific remediation goal for the protection of groundwater and future construction workers. The area is also impacted with Stoddard solvent and TMBs in soil vapor above site-specific remediation goals for potential commercial/industrial indoor air exposure.

- Area 9d: Area north of the scalper and planer machines where soil is impacted with PCBs (Aroclor-1254) at a concentration above the site-specific remediation goal for the protection of future commercial/industrial workers and future construction workers.
- Area 10: Former tube mill Stoddard solvent dip tanks and vault area where soil is impacted with TPH, Stoddard solvent compounds, and BTEX at concentrations above site-specific remediation goals for the protection of groundwater. The area is also impacted with Stoddard solvent and TMBs in soil vapor above site-specific remediation goals for potential commercial/industrial indoor air exposure.
- Area 11: Former tube mill and roll stretcher machine area where soil is impacted with TPH, Stoddard solvent compounds, benzene, ethylbenzene, and xylenes at concentrations above the site-specific remediation goals for the protection of groundwater. The area is also impacted with Stoddard solvent and TMBs in soil vapor above site-specific remediation goals for potential commercial/industrial indoor air exposure.

#### Phase VI Area:

- Area 12: Southern portion of Parcel 7 (near the southern buried railroad tracks) where soil is impacted with arsenic at a concentration above the site-specific background level for this metal (i.e., the remediation goal).

The remediation scenarios include addressing surface and shallow COC-impacted soils and deeper VOC-, PCB-, TPH-, and Stoddard solvent-impacted soils and will be evaluated further in this FS. A detailed evaluation of soil management of shallow COC-impacted areas that will be encountered during below-grade demolition along with excavation and off-site soil disposal is provided in the RAP (AMEC, 2012).

#### **5.4 AREAS WITH PCB-IMPACTED CONCRETE**

PCB-impacted concrete areas exceeding the site-specific remediation goal of 3.5 mg/kg for total Aroclors were identified and are shown on Figure 7. Areas of PCB-impacted concrete were found in Buildings 104, 106, 108, and 110, with a small area of impact in Building 112.

#### **5.5 GENERAL RESPONSE ACTIONS**

GRAs are general categories of action that, when implemented, will meet the RAOs for the Site (U.S. EPA, 1988). Combinations of GRAs may be used to meet the RAOs if needed. Five GRAs that may be applicable to mitigate soil and concrete impacts in this case are summarized below.



- No Action [NCP 40 CFR 300.430(e)(6)]: the CERCLA FS process requires a “no action” alternative to provide a basis of comparison to other remedial actions. All ongoing activities would cease under this response. Natural attenuation, degradation, dispersion, adsorption, dilution, and volatilization are the only processes that would take place and will occur regardless of intervention.
- Institutional controls: institutional controls are typically implemented as a site-management alternative using tools such as deed covenants, water-use restrictions, land-use restrictions, and/or the monitoring of a site condition to prevent unintended use of the site or groundwater. Institutional controls are appropriate for site management when risk to human health or the environment as a result of existing environmental conditions is low or easily managed. Institutional controls may also be used as a component of a more extensive or comprehensive remediation program when full restoration of site conditions is not needed for the intended land and groundwater use.
- Containment: containment can be used to control the movement or mobilization of COCs. A containment technology under consideration is capping, which would provide dermal contact barriers or physical barriers between receptors and soil or concrete impacted with COCs and could also reduce or limit infiltration and leaching of COCs to groundwater. Specific capping remedies may include a physical barrier placed at depth over deeper soil, placement of clean crushed concrete as an interim cap over localized areas of crushed concrete fill materials impacted with COCs, or a sub-slab vapor-barrier component, depending upon COC type and future site use.
- Ex situ treatment: ex situ treatment involves excavating and removing soil or other materials impacted with COCs. Impacted soil can be treated on-Site by technologies such as thermal desorption, aeration, landfarming, or bioremediation and reused as backfill after treatment is complete. Impacted soil can also either be treated and/or disposed off-site at a landfill. An additional COC-impacted media at the Site includes concrete slabs known to be impacted with PCBs. Remedial options for PCB-impacted concrete include ex-situ treatment technology evaluations as described in Sections 6.0 and 7.0.
- In situ treatment: in situ treatments immobilize, destroy, break down, or remove COCs from the impacted soil. In situ treatment involves the application of biological, chemical, or physical processes that reduce toxicity, mobility, and/or mass of COCs. Possible in situ treatment technologies include: bioremediation, bioventing, SVE, in situ thermal desorption, and solidification/stabilization.

## 5.6 PRELIMINARY ARARS EVALUATION

The following section presents an overview of the applicable or relevant and appropriate requirements (ARARs) process and identifies ARARs affecting the RAOs. ARARs are site-specific requirements and involve a two-part analysis: first, an evaluation of whether a given requirement is applicable; then if it is not applicable, whether it is nevertheless relevant and appropriate. As further discussed below a component of the remedy selection process is whether it meets ARARs.



Applicable requirements are those remediation standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal, state, and local law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to the conditions at the site. If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate (U.S. EPA, 1988).

Relevant and appropriate requirements are those remediation standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law, that while not applicable, address problems or situations sufficiently similar to the circumstances of the proposed response action and are well suited to the conditions of the site (U.S. EPA, 1988).

A requirement must be substantive in order to constitute an ARAR for activities conducted on-Site. Procedural or administrative requirements such as permits and reporting requirements are not ARARs. In addition to ARARs, the NCP suggests that lead and support agencies may identify other agency advisories, criteria, or guidance “to-be-considered” (TBC) for a particular release. The TBC category consists of advisories, criteria, or guidance that were developed by U.S. EPA, other federal agencies, or states that may be useful in developing CERCLA remedies [NCP 40 CFR 300.400(g)(3)]. These provisions are, however, only useful in developing remedial action alternatives and are not promulgated federal or state ARARs (U.S. EPA, 1988). Requirements of ARARs and TBCs are generally divided into three categories: chemical-specific, location-specific, and action-specific.

## **6.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES**

This section describes the screening criteria and evaluation of potential remedial technologies to mitigate the COCs identified in this FS. This section also presents the results of the remedial action technology screening process for soil, soil vapor, and concrete at the Site.

### **6.1 SCREENING CRITERIA**

As specified in the NCP 40 CFR 300.430(e)(7)(i),(ii),(iii), remedial technologies are initially screened according to the criteria of effectiveness, implementability, and cost. The objective of this section is to develop a range of potential remedial technologies that can be further evaluated as required by the NCP guidelines. A detailed evaluation is performed on these remedial action alternatives in Section 7.1, and the proposed, preferred remedial alternative is recommended for implementation at the Site in Section 8.0. A proposed public participation program is included in Section 9.0. A RAP is provided in a separate document (AMEC, 2012).

### **6.1.1 Effectiveness**

Effectiveness is evaluated based on how well a technology meets the RAOs, protects human health and the environment in the short and long term; attains federal and state ARARs; significantly and permanently reduces the toxicity, mobility, or volume of hazardous constituents; and is technically feasible and reliable.

### **6.1.2 Implementability**

Implementability is evaluated based on the technical feasibility and availability of a technology, the technical and institutional ability to monitor and maintain a technology, and the administrative feasibility of implementing the technology. Implementability criteria also consider useable Site space or area and schedule constraints as related to implementation of certain technologies, either prior to or in conjunction with proposed future Site use.

### **6.1.3 Cost**

The cost is the total cost of the remedy and is evaluated as the net present value. At the screening stage, a high level of accuracy in estimating costs is not required. CERCLA guidance indicates that an accuracy of -30 percent to +50 percent is acceptable.

## **6.2 EVALUATION PROCESS**

The technology screening evaluation process begins by developing a list of applicable technologies for mitigating COC impacts at the Site. Many of the remedial technologies initially identified for consideration at VOC-, metals-, Stoddard solvent-, and PCB-impacted areas were presumptive remedies. "Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and U.S. EPA's scientific and engineering evaluation of actual performance data on technology implementation" (U.S. EPA, 1993). The objective of using presumptive remedies is to simplify or speed up the selection of a remedial action by eliminating the initial step of identifying and screening a broad variety of alternatives.

The presumptive remedy approach involves selecting remedies that have already been proven to be both feasible and cost-effective for specific site types and/or COCs. Presumptive remedies help promote consistency in remedy selection, improve the predictability of the remedy selection process, and are presumed to be NCP compliant (New York State, 2007).

After identifying those technologies with the greatest potential to meet the site-specific remediation goals described in Section 5.1, each of these remedial technologies was evaluated based on the screening criteria described in Section 6.1. The evaluation process consisted of the following steps.

1. Evaluate the effectiveness of each technology. If a technology is considered effective, retain it for an evaluation of implementability; otherwise eliminate the technology from further consideration.
2. Evaluate the implementability of the remaining technologies. If a technology is considered implementable, retain it for an evaluation of cost-effectiveness; otherwise eliminate the technology from further consideration.
3. Evaluate the cost-effectiveness of the remaining technologies. If a technology is considered cost-effective, retain it for possible incorporation in a remedial alternative; otherwise eliminate the technology from further consideration.

The results of the remedial technologies screening for soil, soil vapor, and concrete in Sections 6.3 and 6.4 are summarized in Tables 26 and 27, respectively. Only those technologies that met all three screening criteria are advanced to the detailed evaluation of remedial action alternatives in Section 7.0.

### **6.3 SOIL TREATMENT TECHNOLOGY SCREENING**

The following sections provide a description of the remedial technologies that were initially screened to mitigate the surface and shallow COC-impacted soil and deeper VOC- and Stoddard solvent-impacted soil at the Site. As shown on Table 26, each technology is either retained or eliminated based on the COC and screening criteria established in Section 6.1 as required pursuant to NCP 40 CFR 300.430 (e)(7)(i)(ii)(iii).

#### **6.3.1 No Action**

A "No Action" alternative is included for evaluation pursuant to NCP 40 CFR 300.430(e)(6) and is retained for comparative purposes. With this alternative, no active remedial action would be implemented at the Site. This alternative would not meet RAOs for the Site, nor would it result in a reduction of mobility, toxicity, or volume of known wastes. The Site would remain in its present state, and there would be no cost associated with this alternative. Naturally occurring processes such as attenuation, degradation, dispersion, adsorption, dilution, and volatilization may result in decreases in COC concentrations depending on the subsurface soil conditions. Pursuant to NCP 40 CFR 300.430(e)(6), this alternative is retained for comparative purposes only.

#### **6.3.2 Institutional Controls**

All of the remedial action alternatives evaluated for the Site, except the No Action alternative, will include some form of institutional controls. These controls include a variety of measures designed to prevent current and future property owners and operators from taking actions that would expose workers or other potential receptors to unacceptable risk, interfere with the effectiveness of the final remedy, convert the Site to an end use that is not consistent with the level of remediation, and/or allow residual COCs to migrate off-site.

Institutional controls include deed covenants, land use and groundwater use restrictions, and zoning controls that may be applicable for the surface/shallow COC-impacted soil and deeper PCB-impacted and VOC-impacted soil remediation scenarios described in this FS. Applying the remediation goal (23 mg/kg) for total Aroclors in soil, remaining shallow soil in the depth interval of 5 to 15 feet bgs may contain PCBs at total Aroclor concentrations less than 23 mg/kg and could be left behind in low-occupancy [as defined in 40 CFR Section 761.61(a)(4)(i)(B)(3)] areas with capping, signage, and deed covenants. Implementation of institutional controls requires agreement between all parties affected or requires agreement between landowner/responsible party and regulatory agency.

The use of institutional controls as a stand-alone alternative does not meet the RAOs for the Site. However, regardless of the remedial alternative selected and implemented, the Site is assumed to operate under some form of institutional controls that dictate a commercial/industrial land use and that identify the uppermost groundwater as not for potable use. As this assumption would be included with each alternative, institutional controls will not be independently evaluated further or included in subsequent remedial alternative evaluations.

### **6.3.3 Containment**

Engineered barriers, such as a surface cap, were considered as a GRA for the shallow COC-impacted soil and deeper PCB-, VOC- and Stoddard solvent-impacted soil. The design of engineered capping barriers is site-specific and depends on the intended functions of the system and the intended future Site use. Barriers can range from a one-layer system of vegetated soil, aggregates or concrete, to a complex multi-layer system of soils, geosynthetics, and/or pavements. The materials used in the construction of barriers include low-permeability and high-permeability soils, low-permeability geosynthetic products, aggregate base, asphalt, concrete, or other surface cover materials.

Capping consists of constructing a cover or cap system that provides a physical barrier to minimize contact exposure to receptors from impacted soil or concrete and may reduce potential infiltration of surface run-off. Vapor barriers use a combination of low-permeability materials including synthetic liners to inhibit VOC-vapor intrusion into buildings or other structures. A vapor barrier can be a component of a capping remedy at redeveloped sites that may contain newly constructed buildings. Vapor barriers can include subslab venting which involves venting soil vapor beneath building foundation slabs as a means of protecting building occupants from vapor intrusion.

Capping and vapor barriers are not retained for further evaluation for shallow COC-impacted soil and deeper VOC- and Stoddard solvent-impacted soil. Capping with concrete as a physical barrier is retained for further evaluation for deeper PCB-impacted soil in localized

areas. The existing concrete slabs at the Site could be considered as a cap or barrier to prevent dermal contact with underlying soils, reduce infiltration, and limit volatile emissions. However, the presence of the existing concrete slabs at or above-grade level at the Site prevents future construction in the subgrade. Therefore, the existing concrete slabs must be removed and the underlying soil impacts must be mitigated. While permanently leaving the existing slabs and pavements in-place could be considered containment, it also represents a form of No Action, does not result in the removal of underlying foundations and footings, and therefore does not meet the RAOs for the Site. Specific details regarding future Site use are undefined, and capping with vapor barriers, if necessary, would be a design component of the proposed future development. Structures such as vapor barriers are not considered or evaluated in this document.

#### **6.3.4 Ex Situ Treatment**

Removal of impacted soils is a widely proven GRA. Removal technologies for soil typically refer to excavation followed by on-Site treatment, off-site treatment, or disposal. Examples of on-Site treatment technologies include low temperature thermal desorption (recycling), stabilization, aeration, and on-Site landfarming or bioremediation. Off-site treatment includes landfill disposal, which may also include treatment such as low temperature thermal desorption, or stabilization, prior to landfilling.

Excavation and removal of impacted soil with off-site landfill disposal is retained for further consideration for surface and shallow COC-impacted soil. No post-excavation on-Site treatment technologies were retained due to soil management controls or other requirements that would be necessary to effectively perform on-Site treatment. These additional components include run-on and run-off controls for storm water management, potential bottom liners under soil stockpiles, control of dust and odor emissions, perimeter air monitoring, potential South Coast Air Quality Management District (SCAQMD) permitting issues, and on-going operations and maintenance requirements. Construction costs associated with implementation of these additional controls will generally negate or off-set any potential cost savings that might typically be associated with on-Site treatment technologies. Although off-site treatment and disposal of COC-impacted soil was retained for further evaluation, this would only be a viable option if the impacted soil is acceptable to a receiving facility. PCB- and metals-impacted soils could be landfilled, while VOC- and Stoddard solvent-impacted soils could either be landfilled or recycled via thermal desorption.

#### **6.3.5 In Situ Treatment**

In situ treatment technologies considered for further evaluation include bioremediation and thermal desorption for organic COC-impacted soils, stabilization for all COC-impacted soils, SVE for VOC-impacted soil, and SVE followed by bioventing for Stoddard solvent-impacted

soils. Stoddard solvent is comprised of approximately 15 percent volatile compounds and approximately 85 percent less volatile straight-chain hydrocarbons. Of the in situ treatment technologies evaluated for COC-impacted soil, SVE was retained for further consideration for both shallow and deep VOC- and Stoddard solvent-impacted soils and bioventing was retained for Stoddard solvent-impacted soils. SVE and bioventing are considered presumptive remedies for VOC- and Stoddard solvent-impacted soils, respectively.

In situ thermal desorption was not retained because it is ineffective on metals-impacted soil or in shallow soil applications less than 6 feet bgs. Thermal desorption is also relatively more expensive when compared to SVE or bioventing technologies for treatment of VOC- or Stoddard solvent-impacted soils, respectively. SVE is effective for VOC-impacted soil present at the Site (including Site-derived VOCs in soil vapor adjacent to the northwest corner of the Site) and could be implemented under current Site conditions; if successful, SVE would meet the RAOs. SVE and bioventing performed in a two-step treatment process is effective for Stoddard solvent-impacted soil present at the Site. SVE would initially be performed to remove the volatile mass fraction estimated to comprise approximately 10 to 15 percent of the mass of the Stoddard solvent impacts. After initial SVE operations reach asymptotic levels, continued in situ remediation would consist of bioventing to degrade the remaining less volatile yet biodegradable fuel-related hydrocarbons present in the Stoddard solvent. SVE and bioventing could be implemented under current Site conditions and, if successful, would also meet RAOs.

Stabilization is also a viable remedial technology for PCB- and metals-impacted soils and is also retained for further consideration. Stabilization is also effective on VOC- and Stoddard solvent-impacted soil although the process would generate fugitive odor emissions that would require collection and treatment. Stabilization has previously been performed at other remediation sites within the City of Vernon. Typically a bench-scale mix design is required to determine the most effective stabilization admixture and corresponding percentage of additive necessary to meet stabilization objectives. Previous case studies suggest PCBs are amenable to stabilization and solidification technologies with simple cement-based additives, although a bench-scale mix study would be required to evaluate site-specific feasibility and an appropriate mix design prior to any field implementation.

#### **6.4 PCB-IMPACTED CONCRETE TREATMENT TECHNOLOGY SCREENING**

The following sections provide a description of the remedial technologies considered to mitigate the PCB-impacted concrete. As shown on Table 27, each technology is either retained or eliminated based on the screening criteria established in Section 6.1.



#### **6.4.1 No Action**

A "No Action" alternative is included for evaluation pursuant to NCP 40 CFR 300.430(e)(6) guidance and is retained for comparative purposes. With this alternative, no active remedial action would be implemented at the Site. This alternative would not meet RAOs for the Site, nor would it provide a reduction of mobility, toxicity, or volume of known wastes. The Site would remain in its present state, and there would be no cost associated with this alternative. Pursuant to NCP 40 CFR 300.130 (e)(6), this alternative is retained for comparative purposes only.

#### **6.4.2 Institutional Controls**

All of the remedial action alternatives evaluated for the Site, except the No Action alternative, will include some form of institutional controls. These controls include a variety of measures designed to prevent current and future property owners and operators from taking actions that would expose workers or other potential receptors to unacceptable risk, interfere with the effectiveness of the final remedy, convert the Site to an end use that is not consistent with the level of remediation, and/or allow residual impacts to move off-site.

Institutional controls can include deed covenants, land use and groundwater use restrictions, and zoning controls that may be applicable for the PCB-impacted concrete described in this FS. The implementation of institutional controls requires agreement between landowner/responsible party and regulatory agency. Federal TSCA regulations (CFR 761.61) require specific institutional controls regarding surface capping, signage, and low- versus high-occupancy Site use, depending on the concentrations of remaining PCBs in concrete. Applying the remediation goal (3.5 mg/kg) for total Aroclors in concrete, concrete containing total Aroclors at concentrations less than 3.5 mg/kg could be reused (as restricted use fill material) in localized areas of the Site, including high-occupancy [as defined in 40 CFR Section 761.61(a)(4)(i)(A)] areas that are capped. Regardless of the remedial alternative selected and implemented, it is assumed that the Site will undergo future new construction to include a commercial/industrial land use. As this assumption would be included with each alternative, institutional controls as a stand-alone alternative do not meet the RAOs for the Site and will not be evaluated further or included in subsequent remedial alternative evaluations.

#### **6.4.3 Ex Situ Treatment**

Ex situ treatment technologies that were considered for PCB-impacted concrete include demolition and disposal. The areas of known PCB impacts to concrete are shown on Figure 7. Demolition and disposal involves saw-cutting or breaking and removing PCB-impacted concrete with concentrations above the remediation goal, followed by transportation to an appropriate off-site disposal facility. PCB-impacted concrete containing total Aroclor concentrations greater than 1 mg/kg but less than the remediation goal of 3.5 mg/kg could be

crushed and placed on-Site as restricted use fill material (on-Site disposal) in localized deeper areas. Demolition and disposal are retained for further consideration for addressing of PCB-impacted concrete present in former building slabs.

#### **6.4.4 In Situ Treatment**

In situ treatment technologies that were considered for PCB-impacted concrete include surficial scarification, encapsulation of intact surface slabs, and decontamination via steam cleaning.

Scarification is an effective treatment for removal of relatively thin surficial layers of concrete. Scarification is performed with grinding equipment that removes concrete layers in thicknesses equivalent to fractions of an inch, while generating noise and dust. Concrete dust associated with scarification would require collection and disposal. Depending on the desired depth of scarification, multiple passes of grinding equipment may be necessary. Additional confirmation sampling would then be necessary. This technology is generally not cost effective if removal depths exceed several inches. Coring data obtained from several areas within Buildings 104, 106, 108, and 112 indicate multiple layers of concrete are present, some with PCB-impacted lower layers overlaid by 2.5 to 4 inches of clean concrete. Scarification is not an effective treatment for this type of alternately impacted multi-layered concrete and is therefore not retained for further consideration.

Encapsulation or sealing of impacted concrete slabs involves physically microencapsulating wastes by sealing them with an applied compound. Encapsulation is typically performed with polymers, resins, or other proprietary binding and sealing compounds that are bonded to the impacted surface. Surface encapsulation effectiveness is limited to the success of the adhesive bond between the coating and the waste (U.S. EPA, 1982). Long term inspection and monitoring is also required to maintain integrity of the sealed areas. Encapsulation is not retained for further evaluation because bench-scale testing of multiple surface sealant compounds would need to be performed to determine the effectiveness of this alternative. Furthermore, surface encapsulation would require the slabs to be left in place. This would not allow demolition of existing below-grade foundations and footings that are being removed as a component of the Site remediation.

Steam cleaning or pressure washing is typically used to remove surficial impacts to both porous and non-porous surfaces. Steam cleaning or pressure washing is most effective on non-porous surfaces such as steel and less effective on porous or deeply impregnated stains. Steam cleaning or pressure washing would be performed as a decontamination step prior to slab demolition. Pressure-washing and steam cleaning of building slabs was performed as a general remediation technique prior to building demolition at the Site to remove surface

accumulations of dust and oils. Post-demolition concrete coring and analytical testing in areas that were previously steam cleaned during above-ground demolition still contained areas where PCBs were detected above site-specific remediation goals. This demonstrates that steam cleaning is not an effective treatment technique for removing PCB impacts or heavily stained surfaces in porous concrete. Furthermore, steam cleaning is not an effective treatment because of the depth of penetration of the PCBs into the concrete slabs, and the presence of alternately contaminated multi-layered concrete slabs. Steam cleaning and pressure washing are not retained for further consideration.

## **7.0 DETAILED EVALUATION OF REMEDIAL ALTERNATIVES**

Section 6.0 screened the available technologies within each of the retained GRA categories, and identified the following remedial alternatives for additional detailed evaluation:

- No action;
- Excavation and off-site landfill disposal for surface and shallow COC-impacted soil and deep VOC-impacted soil;
- In situ stabilization of shallow metals-, Stoddard solvent-, and PCB-impacted soil;
- Capping of deeper PCB-impacted soil;
- SVE for shallow and deep VOC-impacted soil;
- SVE and bioventing for shallow and deep Stoddard solvent-impacted soil; and
- Demolition and disposal of PCB-impacted concrete.

These technologies are combined into potential alternatives for addressing COC-impacted areas at the Site and are further evaluated in Section 7.2 and summarized on Table 28.

### **7.1 EVALUATION CRITERIA**

The detailed evaluation process comprises the development and scoping of remedial alternatives to provide a basis for comparison using additional, more detailed criteria, referred to as balancing criteria, than those initially applied in the screening steps of the FS process. The balancing criteria include those developed by the U.S. EPA in the NCP 40 CFR 300.430(a)(1)(iii) and site-specific criteria developed for this project. Of the nine U.S. EPA balancing criteria, seven are discussed in this FS. The remaining two, acceptance by supporting agencies (such as the DTSC) and acceptance by the community, will be addressed when the supporting agencies and community have reviewed and commented on the RAP. These criteria are described in the following sections.

### **7.1.1 NCP-Based Evaluation Criteria**

NCP-based evaluation criteria are described below.

- Short-term effectiveness [40 CFR 300.430(e)(9)(iii)(E)]: An evaluation of alternatives using this criterion will identify the short-term effectiveness of various alternatives during implementation. As appropriate, the following factors will be addressed: protection of the community, protection of workers, and potential environmental impacts.
- Long-term effectiveness [40 CFR 300.430(e)(9)(iii)(C)]: An evaluation of alternatives using this criterion will define the anticipated results of the RAO in terms of achieving the long-term RAO of COC mass removal and identify the conditions that may remain at the Site after the RAO has been met. Evaluation of the alternatives will also include factors such as treatment residuals.
- Implementability [40 CFR 300.430(e)(9)(iii)(F)]: An evaluation of alternatives using this criterion will identify the technical and administrative feasibility of implementing an alternative. Factors to be considered may include construction and operation, duration monitoring considerations, permits required, and availability of necessary services and materials.
- Overall protection of human health and the environment [40 CFR 300.430(e)(9)(iii)(A)]: An evaluation of alternatives using this criterion will identify how the alternative as a whole achieves, maintains, or supports protection of human health and the environment.
- Compliance with ARARs and implementing agency requirements [40 CFR 300.430(e)(9)(iii)(B)]: An evaluation of alternatives using this criterion will identify how the alternative complies with applicable federal/state/local requirements and guidelines.
- Reduction of toxicity, mobility, or volume through treatment [40 CFR 300.430(e)(9)(iii)(D)]: An evaluation of alternatives using this criterion will define the anticipated performance of the specific treatment technology. The evaluation would consider the amount of COC that will be treated, the degree of expected reduction in toxicity and mobility of the COC, the type and quantity of treatment residuals that will remain, and the degree to which the treatment will be irreversible.
- Cost [40 CFR 300.430(e)(9)(iii)(G)]: This assessment will evaluate the capital and operation and maintenance (O&M) costs for each alternative. The cost estimates will be assessed as capital cost, annual O&M cost, and present worth analysis.

### **7.1.2 Site-Specific Evaluation Criteria**

Site-specific evaluation criteria are described below.

- Applicability based on Site conditions: An evaluation of alternatives using this criterion will identify the applicability of various alternatives relative to site-specific conditions such as hydrogeology, distribution of the COCs in soil and concrete,

impacts on neighboring properties, access restrictions, future land use, and lease and legal issues.

- Time required for planning, design, permitting, construction, and operation: An evaluation of alternatives using this criterion will identify project-specific needs to conduct work within a period of time and identify the steps necessary to prepare for and accomplish that work.
- Integration with other project elements: An evaluation of alternatives using this criterion will identify the extent to which an alternative is integrated and consistent with other known project elements and activities.

## **7.2 DESCRIPTION AND EVALUATION OF REMEDIAL ALTERNATIVES**

This section describes the remedial alternatives that were retained from the evaluation performed in Section 6.0 to address each remedial COC. These alternatives are described below. Each alternative is then evaluated against the NCP 40 CFR 300.430(e)(9)(iii) evaluation criteria presented in Section 7.1.1 and summarized in Table 28.

### **7.2.1 Alternative 1**

#### **No Action**

Alternative 1 consists of “No Action” and is included for evaluation pursuant to NCP 40 CFR 300.430(e)(6) and retained for comparison purposes. No below-grade demolition or soil remediation would be performed.

- **Overall Protection of Human Health and the Environment**  
No Action would not be protective of human health and the environment and would not meet the RAOs for the Site.
- **Compliance with ARARs**  
This alternative will not meet ARARs in a reasonable time frame.
- **Long-Term Effectiveness**  
No Action would not achieve the RAOs for the Site.
- **Reduction of Toxicity, Mobility, and Volume through Treatment**  
This alternative would provide limited reduction of toxicity, mobility, and volume with implementation.
- **Short-Term Effectiveness**  
No Action would not achieve the RAOs for the Site.
- **Implementability**  
There is no additional effort required for implementation of this alternative.
- **Costs**  
There are no costs associated with this alternative.

The Site may have a future commercial or industrial land use. These construction activities would require below-grade demolition and soil remediation. In addition, the “No Action” alternative fails to meet the RAOs for the Site. “No Action” is not a viable alternative.

### **7.2.2 Alternative 2**

#### **Excavation and Disposal of COC-Impacted Soil and Demolition and Disposal of PCB-Impacted Concrete**

Alternative 2 consists of excavation and off-site disposal of shallow and deep COC-impacted soil (metals, PCBs, Stoddard solvent, and VOCs) to depths of approximately 8 feet bgs for metals, 15 feet bgs for PCBs, and 45 to 50 feet bgs for VOCs and Stoddard solvent. Vadose zone VOC remediation will promote a reduction in VOC concentrations in groundwater beneath the northern portion of the Site. Excavation will require installation of shoring for sidewall stability and safety during soil removal. This alternative also includes demolition and off-site disposal of concrete slabs containing PCB concentrations greater than or equal to 3.5 mg/kg. PCB-impacted concrete at concentrations greater than 1.0 mg/kg and less than 3.5 mg/kg would be crushed and deposited on-Site as restricted use fill material (i.e., on-Site disposal) and covered with an interim cap consisting of a visual identifier layer and a minimum of 12 inches of clean crushed concrete (unrestricted use fill material). Non-PCB-impacted concrete (less than or equal to 1.0 mg/kg) would be crushed and reused on-Site as unrestricted use fill material. A land use covenant that incorporates an O&M plan and soil management plan (SMP) would also be included in this alternative.

- **Overall Protection of Human Health and the Environment**  
This alternative would meet the RAOs of mitigating shallow COC-impacted soils and PCB-impacted concrete above the site-specific remediation goals for the Site. Excavation poses no overall element of risk to human health or the environment.
- **Compliance with ARARs**  
This alternative would be protective of human health and environment and would be expected to meet ARARs.
- **Long-Term Effectiveness**  
This alternative would prevent human exposure by eliminating pathways between future receptors and soil, soil vapors, recycled concrete, and airborne dusts. Removal of VOC-impacted soil in the northern portion of the Site will promote long-term natural attenuation of VOCs in groundwater.
- **Reduction of Toxicity, Mobility, and Volume through Treatment**  
This alternative would reduce the toxicity, mobility, and volume of COC-impacted soils and PCB-impacted concrete.
- **Short-Term Effectiveness**  
Risk to receptors and the environment is low if appropriate personal protective



equipment (PPE) is worn by workers and dust, noise, and odor controls are implemented.

- **Implementability**

The technologies in this alternative are reliable and effective. Impacted areas would need to be well defined, and implementation is relatively straightforward using commercially available equipment. Shoring or other stability controls are required during excavation.

- **Costs**

Costs for this alternative were based on an excavation rate of 500 cubic yards per day and confirmation sample rate of one sample per 200 cubic yards of excavated material. Shoring costs are included in all proposed excavation areas greater than 10 feet bgs. Waste management costs associated with landfill disposal of soils impacted with metals, VOCs, and Stoddard solvent were estimated assuming that 90 percent of the soil waste is classified as a non-hazardous waste and 10 percent of the soil waste is classified as a hazardous waste. PCB soil waste disposal assumes 30 percent is classified as non-TSCA waste and 70 percent is TSCA waste. Average thickness of the PCB-impacted concrete slabs was assumed to be 12 inches. Estimated total capital cost for this alternative is \$33,200,000 and summarized in Appendix G.

Excavation and disposal of all COC-impacted materials is a proven and reliable technology. Because of the required excavation depths for deeper soil, it is also relatively more expensive than other competing technologies.

### 7.2.3 Alternative 3

#### **Excavation and Disposal of Shallow COC-Impacted Soil, SVE for Shallow and Deep VOC-Impacted Soil, SVE and Bioventing for Shallow and Deep Stoddard Solvent-Impacted Soil, and Demolition and Disposal of PCB-Impacted Concrete**

Alternative 3 consists of excavation and off-site disposal of shallow COC-impacted soil (PCBs and metals) to depths of approximately 15 feet bgs. Shallow and deep VOC- and Stoddard solvent-impacted soil would be mitigated using SVE and SVE with bioventing, respectively. Vadose zone VOC remediation will promote a reduction in VOC concentrations in groundwater beneath the northern portion of the Site. Deeper soil (at depths greater than 15 feet) impacted with PCBs above the remediation goal would be left in place and covered with a physical barrier at depth. The physical barrier would consist of 6 inches of cement concrete. This alternative also includes demolition and off-site disposal of PCB-impacted concrete slabs containing PCB concentrations greater than 3.5 mg/kg. PCB-impacted concrete at concentrations greater than 1.0 mg/kg and less than 3.5 mg/kg would be crushed and deposited on-Site as restricted use fill material (i.e., on-Site disposal) and covered with an interim cap consisting of a visual identifier layer and a minimum of 12-inches of clean crushed concrete (unrestricted use fill material). Non-PCB-impacted concrete (less than or equal to

1.0 mg/kg) would be crushed and reused on-Site as unrestricted use fill material. A land use covenant that incorporates an O&M plan and SMP would also be included in this alternative.

- **Overall Protection of Human Health and the Environment**

This alternative would meet the RAOs of mitigating shallow COC-impacted soils, PCB-impacted concrete, and deeper VOC- and Stoddard solvent-impacted soils above the site-specific remediation goals for the Site. Excavation, SVE and bioventing pose no overall element of risk to human health or the environment.

- **Compliance with ARARs**

This alternative would be protective of human health and environment and would be expected to meet ARARs.

- **Long-Term Effectiveness**

This alternative would prevent human exposure by eliminating pathways between future receptors and soil, soil vapors, recycled concrete and airborne dusts. In addition, SVE and bioventing are presumptive remedies and can achieve site-specific remediation goals for VOC- and Stoddard solvent-impacted soils. Remediation of the VOC-impacted soil in the northern portion of the Site will promote long-term natural attenuation of VOCs in groundwater.

- **Reduction of Toxicity, Mobility, and Volume through Treatment**

This alternative would reduce the toxicity, mobility, and volume of shallow and deep COC-impacted soils and PCB-impacted concrete.

- **Short-Term Effectiveness**

Risk to receptors and the environment is low if appropriate PPE is worn by workers and dust, noise, and odor controls are implemented.

- **Implementability**

The technologies in this alternative are presumptive remedies documented to be reliable and effective. Impacted areas would need to be well defined, and implementation is relatively straightforward using commercially available equipment and effective monitoring programs for the SVE and bioventing systems. Shoring or other stability controls are required during excavation. Necessary permits must be obtained for operation of the SVE systems along with a monitoring and reporting program after system start-up.

- **Costs**

Costs for this alternative were based on an excavation rate of 500 cubic yards per day and confirmation sample rate of one sample per 200 cubic yards of excavated material. Shoring costs are included in all proposed excavation areas greater than 10 feet bgs. Waste management costs associated with landfill disposal were estimated assuming that 30 percent of the soil waste is classified as a non-TSCA waste and 70 percent of the soil waste is classified as a TSCA waste. Average thickness of the PCB-impacted concrete slabs was assumed to be 12 inches. SVE costs include rental of a minimum 1000 cubic feet per minute (cfm) system with continued operation over a three year period. Bioventing costs include operation of a SVE system for three months followed by operation of a low-flow, pulsed air

injection system over a three year period. Estimated total capital cost for this alternative is \$4,400,000 and summarized in Appendix G.

Excavation and disposal of shallow COC-impacted materials, along with SVE for shallow and deep VOC-impacted soils, and SVE with bioventing for Stoddard solvent-impacted soils, meet the RAOs for the Site and provides a balanced alternative that is both cost-effective and protective of human health and the environment.

#### **7.2.4 Alternative 4**

##### **In Situ Stabilization of Shallow PCB/Metals-Impacted Soil and Deep Stoddard Solvent-Impacted Soil, SVE for Shallow and Deep VOC-Impacted Soil, and Demolition and Disposal of PCB-Impacted Concrete.**

Alternative 4 consists of in situ stabilization of shallow PCB- and metals-impacted soil and deep Stoddard solvent-impacted soil, using a cement-based additive to depths of approximately 15 feet bgs for PCB- and metals-impacted soil and 50 feet bgs for Stoddard solvent-impacted soil. Shallow and deep VOC-impacted soil would be addressed using SVE. Vadose zone VOC remediation will promote a reduction in VOC concentrations in groundwater beneath the northern portion of the Site. This alternative also includes demolition and off-site disposal of concrete slabs containing PCB concentrations greater than 3.5 mg/kg. PCB-impacted concrete at concentrations greater than 1.0 mg/kg and less than 3.5 mg/kg would be crushed and deposited on-Site as restricted use fill material (i.e., on-Site disposal) and covered with an interim cap consisting of a visual identifier layer and a minimum of 12-inches of clean crushed concrete (unrestricted use fill material). Non-PCB-impacted concrete (less than or equal to 1.0 mg/kg) would be crushed and reused on-Site as unrestricted use fill material. A land use covenant that incorporates an O&M plan and SMP would also be included in this alternative.

- **Overall Protection of Human Health and the Environment**  
This alternative would not meet the RAOs of mitigating shallow and deep COC-impacted soils above the site-specific remediation goals because stabilization does not reduce the volume and may only partially reduce toxicity of COCs. PCB-impacted concrete and deeper COC-impacted soil RAOs for the Site would be met with this alternative. The technologies applied in this alternative pose no overall element of risk to human health or the environment.
- **Compliance with ARARs**  
This alternative would be protective of human health and environment and would be expected to meet ARARs.
- **Long-Term Effectiveness**  
This alternative would prevent human exposure by eliminating pathways between future receptors and soil, soil vapors, recycled concrete, and airborne dusts. In addition, SVE is a presumptive remedy and can achieve site-specific remediation goals for VOC-impacted soils. Remediation of the VOC-impacted soil in the

northern portion of the Site will promote long-term natural attenuation of VOCs in groundwater.

- **Reduction of Toxicity, Mobility, and Volume through Treatment**  
This alternative would reduce the toxicity, mobility, and volume of deeper VOC-impacted soils and PCB-impacted concrete. Soil stabilization would reduce the mobility of shallow and deep COC-impacted soils, but volume and toxicity would not be significantly reduced through treatment.
- **Short-Term Effectiveness**  
Risk to receptors and the environment is low if appropriate PPE is worn by workers and dust, noise, and odor controls are implemented.
- **Implementability**  
The technologies in this alternative are reliable and effective. Impacted areas would need to be well defined, but implementation of technologies is relatively straightforward. Soil stabilization requires a bench-scale test and mobilization of a large diameter crawler-mounted auger drilling rig. Necessary permits must be obtained for operation of the SVE system, along with a monitoring and reporting program after system start-up.
- **Costs**  
Costs for this alternative were based on a stabilization rate of 300 cubic yards per day, maximum stabilization depth of 50 feet bgs, and a stockpile confirmation sample rate of one sample per 200 cubic yards. Cement-mixing-additive assumed to be 10 percent of the stabilization material for cost estimation purposes. Cost assumes 20 percent of mixed volume requires off-site disposal. Waste management costs associated with landfill disposal were estimated assuming that 90 percent of the soil waste is classified as a non-hazardous waste and 10 percent of the soil waste is classified as a hazardous waste. Average thickness of the PCB-impacted concrete slabs was assumed to be 12 inches. SVE costs include rental of a minimum 1000 cfm system with continued operation over a three year period. Estimated total capital cost for this alternative is \$14,300,000 and summarized in Appendix G.

SVE is a presumptive remedy that is well-suited to address the VOC-impacted areas on the Site. Based on the large volumes of Stoddard solvent-impacted soil, in situ stabilization is more expensive than other technologies such as bioventing.

## 8.0 PROPOSED PREFERRED REMEDIAL ALTERNATIVES

This section describes the proposed preferred remedial alternative selected to mitigate the remedial COC scenarios evaluated through this FS process. Alternative 3 is the proposed preferred alternative and consists of excavation and off-site disposal of surface and shallow COC-impacted soil, placing a physical barrier over deeper PCB-impacted soil left in place (at depths below 15 feet), SVE for shallow and deep VOC-impacted soil, and SVE and bioventing for Stoddard solvent-impacted soil. In addition, remediation of VOC-impacted soil will promote long-term natural attenuation of VOCs in groundwater. PCB-impacted concrete with

concentrations above the remediation goal in building slabs will be mitigated using demolition and off-site disposal. PCB-impacted concrete at concentrations greater than 1.0 mg/kg and less than 3.5 mg/kg would be crushed and deposited on-Site as restricted use fill material (i.e., on-Site disposal). Non-PCB-impacted concrete (less than or equal to 1.0 mg/kg) would be crushed and reused on-Site as unrestricted use fill material. A land use covenant that incorporates an O&M plan and SMP would also be included in this alternative. Alternative 3 is the most cost-effective alternative that meets both the short-term and long-term effectiveness criteria. It also provides for a greater reduction of toxicity, mobility, and volume when compared to Alternative 4 and it is protective of human health and the environment. The components of Alternative 3 are further described below.

### **8.1 DEMOLITION AND DISPOSAL OF PCB-IMPACTED CONCRETE**

Concrete slabs with PCB concentrations that exceed the proposed site-specific remediation goal of 3.5 mg/kg will be demarcated in the field by marking the slab surface. PCB-impacted concrete slabs will then be saw cut or broken, removed, and transported off-site for disposal at an appropriate landfill facility permitted to accept PCB remediation waste.

Concrete slabs with PCB concentrations greater than 1.0 mg/kg and less than 3.5 mg/kg will be demarcated in the field by marking the slab surface. PCB-impacted concrete slabs will then be saw cut or broken, and sized by crushing or pulverizing to facilitate handling. These materials are proposed to be placed as restricted use backfill material (i.e., on-Site disposal) within the upper 15 feet in open excavation areas (such as Areas 4a and 4b shown on Figure 14) after COC-impacted soil removal has been completed. This restricted use fill location will then be covered with an interim cap as required by U.S. EPA, as will be proposed in the RAP.

### **8.2 EXCAVATION AND DISPOSAL OF SURFACE/SHALLOW COC-IMPACTED SOIL**

The proposed preferred remedial technology for surface and shallow COC-impacted soil containing PCBs, Stoddard solvent, and metals concentrations exceeding site-specific remediation goals is excavation and off-site disposal. Excavation activities will be followed by backfilling and compaction with crushed, recycled aggregates obtained from the on-Site demolition and crushing of slabs and foundations as discussed in the RAP. In the unlikely event that additional fill is required, clean soil will be imported from an off-site source.

Deeper PCB-impacted soil (at depths greater than 15 feet) will be left in place (Areas 4a and 4b) and covered at depth with a physical barrier comprised of concrete, as proposed in the RAP.

### **8.3 SVE FOR SHALLOW AND DEEP VOC-IMPACTED SOIL**

The preferred remedial technology for shallow and deep VOC-impacted soil in the Phase I area is to install and operate an SVE system where VOC concentrations exceed site-specific remediation goals. The SVE system will be operated until VOC concentrations in the effluent air stream reach asymptotic conditions. The system will then be shut-down to undergo vapor rebound testing, followed by additional operations as necessary. System performance and termination of operations will be based on monitoring of in situ soil vapor concentrations obtained from soil vapor confirmation sampling performed after completion of vapor rebound testing and confirmation soil sampling. Post-remediation soil matrix confirmation sampling will be performed in previously defined VOC hot spot areas upon completion of rebound testing and termination of SVE. While future site use may limit physical access into certain areas, efforts will be made to obtain soil samples from approximate locations consistent with previous VOC characterization sampling events in the VOC impacted areas. Approximately six soil borings will be advanced to groundwater and eight soil samples per boring will be obtained from both above and below the fine grained unit. Samples will be analyzed for VOCs using U.S. EPA Method 8260B/5035. Soil sample results will be used to document the remaining concentrations of the VOCs in soil for a land use covenant for the Site.

### **8.4 SVE AND BIOVENTING FOR SHALLOW AND DEEP STODDARD SOLVENT-IMPACTED SOIL**

The preferred remediation technology for shallow and deep Stoddard solvent-impacted soil in the Phase IIIb and Phase IV areas is to install and operate a SVE and bioventing system where Stoddard solvent COCs exceed site-specific remediation goals. SVE will be performed initially to remove the volatile fraction of Stoddard solvent COCs. The system will then be reconfigured to operate as a bioventing system to address the remaining Stoddard solvent-impacted soil.

Bioventing is a soil bioremediation technology that involves aeration of soils to stimulate and promote biodegradation of fuel-related hydrocarbon constituents. In contrast to SVE, bioventing uses low air flow rates only to provide oxygen to sustain microbial activity. The addition of nutrients and moisture is typically not required (Air Force Center for Environmental Excellence [AFCEE], 1996a). Bioventing relies on forced air injection (or vacuum venting) to deliver oxygen that is required to maintain the biodegradation process. Oxygen is most commonly supplied through screened vent wells similar to those used in SVE systems. In addition to degradation of absorbed hydrocarbon residuals, residual volatile compounds are biodegraded as vapor moves slowly through biologically active soil.

Oxygen is generally the limiting factor with intrinsic aerobic bioremediation, becoming depleted because respiration rates generally exceed rates of oxygen recharge via natural diffusion. Bioventing enhances and accelerates the natural biodegradation process by providing oxygen



as a source of electron acceptors to naturally-occurring microorganisms. These microorganisms degrade the fuel hydrocarbon constituents by using them as a carbon source for cell production that generates carbon dioxide during respiration. Although soil microorganisms are capable of degrading fuel hydrocarbons under both anaerobic and aerobic conditions, biodegradation rates are typically much faster under aerobic conditions.

Bioventing treatability studies have been demonstrated at over 145 U.S. Air Force sites and regulatory acceptance of bioventing remedies has been achieved in 38 states (including California) and all 10 U.S. EPA regions (AFCEE, 1996b).

Soil gas monitoring will consist of measuring the concentrations of carbon dioxide, oxygen, and methane in the vent wells. The system will be operated until soil gas monitoring results collected from the vent wells indicate biodegradation is complete. Soil confirmation sampling will then be performed. Post-remediation soil matrix confirmation sampling will be performed in previously defined hot spot areas upon completion of bioventing to substantiate treatment completion and, if necessary, to support a land use covenant for the Site.

## **9.0 PUBLIC PARTICIPATION**

As required by the NCP 40 CFR 300.430(c)(1) and DTSC, Pechiney will ensure that the public is informed and has the opportunity to participate in the overall remedial action for the Site. A comprehensive community involvement plan will be submitted following the submittal of the FS and RAP. Public participation will be implemented as part of demolition and remediation of the Site. The community involvement program and activities are described below.

### **9.1 COMMUNITY INVOLVEMENT PROGRAM**

The objective of the community involvement program is to inform the community of the progress of demolition and remediation activities and to effectively respond to health, environment and safety concerns and questions. The community involvement program will be consistent with DTSC requirements and CERCLA as implemented by the NCP 40 CFR 300.430(c)(1). The purpose of these activities as stated by the NCP 40 CFR 300.430(c)(2)(ii)(A) is to “ensure the public appropriate opportunities for involvement in a wide variety of Site related decisions, including Site analysis and characterization, alternatives analysis, and selection of remedy; and to determine, based on community interviews, appropriate activities to ensure such public involvement.”

Objectives of the community involvement program include:

- soliciting input from the community on concerns about the remedial activities;

- establishing effective channels of communication between the community, Pechiney, and DTSC;
- informing the community about progress of the remedial activities; and
- providing adequate opportunities for the community to participate and comment on the proposed remedial activities.

## **9.2 COMMUNITY INVOLVEMENT ACTIVITIES**

To date, Pechiney has conducted community outreach activities to its immediate neighbors including face-to-face visits from the project and field engineers. As part of the below-grade demolition phase of the project, DTSC has begun the community interviews and may distribute information to the immediate neighbors of the Site including proposed activities and schedule of work.

Prior to the start of remediation, DTSC will expand its outreach and distribute an information fact sheet to businesses and residents surrounding the Site and to other interested stakeholders. This fact sheet will include information about the Site, remedial activities, and project contacts. Additionally, a local information repository will be established to make documents and other information available for the public and a Site mailing list will be developed.

The RAP will be made available to the public for a comment period of at least 30 days. DTSC will respond to any comments received during the public comment period and will provide a timely opportunity for the public to access documents.

Depending on the level of community response and level of interest, DTSC may hold a community meeting to discuss the components of the RAP, the Site's history, and proposed remedial work. The meeting may also provide the opportunity for the public to submit comments on the RAP. DTSC will work with the community to develop a meeting format that suits the community's needs.

## 10.0 REFERENCES

- Air Force Center for Environmental Excellence (AFCEE), 1996a, A General Evaluation of Bioventing for Removal Actions at Air Force/Department of defense Installations Nationwide, General Engineering Evaluation/Cost Analysis, June.
- AFCEE, 1996b, Bioventing Performance and Cost Results from Multiple Air Force Test Sites, Technology Demonstration Final Technical Memorandum, June.
- Agency for Toxic Substances and Disease Registry (ATSDR), 1999, Toxicological Profile for Total Petroleum Hydrocarbons (TPH), U.S. Department of Health and Human Services, September.
- A.J. Ursic, Jr., 1999a, Aluminum Company of America Divestiture of The Alcoa Cast Plate Facility, Parcels 6, 7, and 8, Vernon, California, May 28.
- A.J. Ursic, Jr., 1999b, Aluminum Company of America Divestiture of The Alcoa Cast Plate Facility, Parcels 6, 7, and 8, Vernon, California, July 26.
- A.J. Ursic, Jr., 1999c, Aluminum Company of America Divestiture of The Alcoa Cast Plate Facility, Parcels 6, 7, and 8, Vernon, California, August 16.
- Aluminum Company of America (Alcoa), 1997, Letter to City of Vernon regarding Closure of Groundwater Monitoring Wells, November 13.
- Alcoa, 1999, Recommendation for Site Closure, Request of NFA Designation, February 18.
- Alcoa, 2006, Letter to City of Vernon regarding Stoddard Solvent Contamination, 3200 Fruitland Avenue, August 30.
- Alcoa Technical Center, 1996a, Stoddard Solvent Soil Treatability Evaluation, Alcoa Vernon, CA, January.
- Alcoa Technical Center, 1996b, Addendum Report, Technical Rationale Supporting Intrinsic Bioremediation of Stoddard Solvent Area Soils at Alcoa's Vernon California Facility, Evidence of On-Going Anaerobic Biodegradation.
- Alcoa Technical Center, 1996c, Intrinsic Bioremediation of Stoddard Solvent Area Soils at Alcoa's Vernon California Facility.
- AMEC Geomatrix, Inc. (AMEC), 2009, Polychlorinated Biphenyls Notification Plan, Former Pechiney Cast Plate Facility, Vernon, California, July 10.
- AMEC, 2010, Concrete and Soil Sampling and Analysis Plan, Former Pechiney Cast Plate Facility, Vernon, California, July 27.
- AMEC, 2011, Below Grade Demolition Plan, Pechiney Cast Plate, Inc. Facility, Vernon, California, revised November 27.
- AMEC, 2012, Remedial Action Plan, Former Pechiney Cast Plate Facility, Vernon, California, May 7.

Bradford, G.R., A.C. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright, 1996, Background Concentrations of Trace and Major Elements in California Soils, Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California, March.

CCG Group, Inc., 1995, Final Report for Closure, Underground Storage Tank Removal and Replacement, Alcoa Vernon Works Facility, May.

City of Vernon Health & Environmental Control (H&EC), 1999, letter to Alcoa re: final closure documents for Parcels 6, 7, and 8 at the Aluminum Company of America (Alcoa) site located at 5151 Alcoa Ave., Vernon CA, September 2.

City of Vernon H&EC, 2005, memorandum to Bruce V. Malkenhorst Jr., Acting City Clerk, regarding (Preliminary Draft) Phase I Environmental Site Assessment & Phase II Environmental Site Assessment Work Plan for Pechiney Cast Plate Facility at 3200 Fruitland Ave., Vernon, CA, September 26.

City of Vernon H&EC, 2006, letter to Alcoa, regarding Stoddard Solvent Contamination for 3200 Fruitland Avenue, July 18.

City of Vernon H&EC, 2007, letter to Ms. Linda Conlan re: Polychlorinated Biphenyls (PCBs) Notification Plan; Alcan/Pechiney Cast Plate, 3200 Fruitland Avenue, Vernon, CA 90058, February 6.

Department of Toxic Substances Control (DTSC), 1996, Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities, Office of the Scientific Advisor, California Environmental Protection Agency, Department of Toxic Substances Control, Sacramento, California.

DTSC, 1997, Selecting Inorganic Constituents as Chemicals of Potential Concern at Risk Assessments at Hazardous Waste Sites and Permitted Facilities, Human and Ecological Risk Division (HERD), February

DTSC, 1999a, Preliminary Endangerment Assessment Guidance Manual, California Environmental Protection Agency, Department of Toxic Substances Control, Sacramento, California.

DTSC, 1999b, Assessment of Health Risks from Inorganic Lead in Soil: Lead Spread Model, Version 7, Department of Toxic Substances Control, Sacramento, California.

DTSC, 2005, Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Military Facilities, Human and Ecological Risk Division, HHRA Note Number 1, October 27.

DTSC, 2009, Evaluating Human Health Risks from Total Petroleum Hydrocarbons (TPH), Interim Guidance, Human and Ecological Risk Division, California Department of Toxic Substances Control, Sacramento, California, June 16.

DTSC, 2010, Imminent and Substantial Endangerment Determination and Consent Order (Order) between the California Department of Toxic Substances Control (DTSC) and Pechiney Cast Plate, Inc. (Pechiney; the Respondent), July 6.

Department of Water Resources (DWR), 1961, Planned Utilization of the Ground Water Basins of the Coastal Plain of Los Angeles County, Bulletin 104, June.

Environmental Data Resource, 2005, The EDR Radius Map with GeoCheck, Alcan Aluminum/Pechiney Plastics, 3200 Fruitland Avenue, Vernon, CA 90058, May 26.

Environmental Audit, Inc., 2009, Fourth Quarter Groundwater Monitoring and Remediation Report, North Parcel, 2911 East Slauson Avenue, Huntington Park, California, February.

Environmental Protection and Compliance, Inc., 2006, Stoddard Solvent Impacted Soils Investigation in Support of Monitored Natural Attenuation Survey No. 5, September 26-October 4, 2005, former Alcoa Vernon Facility, Vernon, California, May 25.

Enviro-Wise Consulting, 1998, Phase I Environmental, Health & Safety Assessment Report, Alcoa Cast Plate, 5151/5401 Alcoa Avenue, Vernon, California, 90058, August 13.

Geomatrix Consultants, Inc., (Geomatrix) 2005a, Phase I Environmental Site Assessment, Pechiney Cast Plate Facility, Vernon, California, September 1.

Geomatrix, 2005b, Preliminary Draft Phase II Environmental Site Assessment Work Plan, Pechiney Cast Plate Facility, Vernon, California, September 2.

Geomatrix, 2006a, Below Grade Demolition Plan, Pechiney Cast Plate, Inc. Facility, Vernon, California, December.

Geomatrix, 2006b, Phase II Environmental Site Assessment Report, Pechiney Cast Plate Facility, Vernon, California, March 9.

Geomatrix, 2006c, Supplemental Phase II Environmental Site Assessment Report, Pechiney Cast Plate Facility, Vernon, California, December 19.

Geomatrix, 2006d, Above Grade Demolition Completion Report, Pechiney Cast Plate, Inc. Facility, Vernon, California, December 26.

Geoscience, 2005, Hydrogeological Evaluation of City of Vernon Ground Water Supplies, October 21.

Geraghty & Miller, Inc., 1991, Final Phase I Hydrogeology Investigation, Alcoa-Vernon Plant, 5151 Alcoa Avenue, Vernon, California, March 6.

Geraghty & Miller, Inc., 1995, Submittal of Well Destruction Plan, Alcoa-Vernon Works, 5151 Alcoa Avenue, Vernon, California, June 19.

Harbaugh, A.W., E.R. Banta, M.C. Hill, and M.G. McDonald, 2000, MODFLOW-2000, The U.S. Geological Survey Modular Ground-water Model – User Guide to Modularization Concepts and the Ground-Water Flow Process: U.S. Geological Survey Open-File Report 00-92, p. 121.

HydroGeologic, Inc., 2006, MODFLOW-SURFACT (version 3.0), Reston, Virginia, May.

Johnson, P.C., and R. A. Ettinger, 1991, Heuristic Model for Predicting the Intrusion of Contaminant Vapors into Buildings, *Environmental Science and Technology*, v. 25, n. 8, p. 1445 – 1452.

Morrison Knudsen Corporation, 1995, Final Report Stoddard Solvent System Field Investigation, Aluminum Company of America, October 27.

National Research Council, 1988, *Chemical Mixtures*, National Academy Press, Washington, D.C.

New York State, 2007, Presumptive/Proven Remedial Technologies for New York State's Remedial Programs, Division of Environmental Remediation, Department of Environmental Conservation, February 27.

Office of Environmental Health Hazard Assessment (OEHHA), 2001, Proposition 65, Process for Developing Safe Harbor Numbers, California Environmental Protection Agency, February.

OEHHA, 2003, Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, California Environmental Protection Agency, August.

OEHHA, 2004, Notice of Proposed Rulemaking, Title 22, California Code of Regulations, Amendment to Section 12705, Specific Regulatory Levels Posing No Significant Risk, California Environmental Protection Agency, July.

OEHHA, 2005, Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil, California Environmental Protection Agency, January.

OEHHA, 2009, Revised California Human Health Screening Levels for Lead, California Environmental Protection Agency, September.

OHM Remediation Services Corporation, 1992, Report of Underground Tank Removal, December.

Parametric Technology Corporation, 2007, Mathcad (version 14.0), Needham, Massachusetts, February.

Presidential/Congressional Commission of Risk Assessment and Risk Management (Risk Commission), 1997, Final Report, Volume 2, Risk Management in Regulatory Decision-Making.

Ravi, V. and J.A. Johnson, 1994, VLEACH (version 2.1), Center for Subsurface Modeling Support, Robert Kerr Environmental Research Laboratory, Ada, Oklahoma.

Regional Water Quality Control Board, Los Angeles Region (RWQCB), 1994, Water Quality Control Plan, Los Angeles Region, Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties, June 13.

RWQCB, 1996, Interim Site Assessment & Cleanup Guidebook, Updated March 2004, May.



RWQCB – Los Angeles Region, 2002, letter to Alcoa re: underground tank program closure request, Alcoa Aluminum, 5151 Alcoa Avenue, Los Angeles, May 20.

RWQCB – Los Angeles Region, 2008a, letter to Alcoa re: Underground Storage Tank Program - Response to Unauthorized Underground Storage Tank s Release – Health and Safety Code Section 25296.10 and Title 23, Chapter 16, California Code of Regulations, Section 2720-2727 – Former Alcoa Facility (Priority A-1 Site), 5151 Alcoa Avenue, Vernon, CA (File No. 900580043), March 28.

RWQCB – Los Angeles Region, 2008b, letter to Alcoa re: Underground Storage Tank Program – Closure Review and AB 681 Pre-Closure Notification, Former Alcoa Facility (Priority A-1 Site), 5151 Alcoa Avenue, Vernon, CA (File No. 900580043), December 18.

RWQCB, 2009, Letter to Alcoa, re: Underground Storage Tank Program – Case Closure Former Alcoa Facility (Priority A-1 Site), 5151 Alcoa Avenue, Vernon, CA (File No. 900580043), January 16.

Seed, J., R.P. Brown, S.S. Olin, and J.A. Foran, 1995, Chemical Mixtures: Current Risk Assessment Methodologies and Future Directions, Regulatory Toxicology and Pharmacology, 22:76-94.

Tetra Tech, Inc., May 2011, Site Investigation Report, Vernon/Commerce Discovery Project, Phase I Sites, Vernon, Commerce, Maywood and Huntington Park, California, February 2012

Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG), 1998, Total Petroleum Hydrocarbon Criteria Working Group Series, Volume 2, Composition of Petroleum Mixtures, May.

United States Environmental Protection Agency (U.S. EPA), 1982, Guide to the Disposal of Chemically Stabilized and Solidified Waste, SW-872, September.

U.S. EPA, 1988, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Office of Emergency and Remedial Response, Directive 9355.3-01, October.

U.S. EPA, 1989, Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, (Part A), Office of Emergency and Remedial Response, Directive 9285.701A, December.

U.S. EPA, 1990, National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Final Rule), Code of Federal Regulations, Office of the Federal Register, Updated January 1992.

U.S. EPA, 1991, Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, Office of Solid Waste and Emergency Response, OSWER Directive 9355.0-30, April 22.

U.S. EPA, 1993, Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with VOCs in Soils, EPA 540-F-93-048.

- U.S. EPA, 1995, Land Use in the CERCLA Remedy Selection Process, Directive 9355.7-04, Office of Solid Waste and Emergency Response, May.
- U.S. EPA, 1996, Soil Screening Guidance: Users Guide and Technical Background Document, Office of Solid Waste and Emergency Response, Washington, D.C., EPA/540/R-95/128, May.
- U.S. EPA, 2004, Region IX Preliminary Remediation Goals (PRGs), 2004.
- U.S. EPA, 2005, U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee Version date 05/19/05. <<http://www.epa.gov/superfund/lead/products.htm#alm>>.
- U.S. EPA, 2010a, Polychlorinated Biphenyls – U.S. EPA Conditional Approval Under 40 CFR 761.61(c), Toxic Substances Control Act – “Polychlorinated Biphenyls Notification Plan, Former Pechiney Cast Plate, Inc., Facility, Vernon, California, July 9, 2009,” Letter from Jeff Scott, Director, Waste Management Division, to Donald Thompson, President Pechiney Cast Plate, July 2.
- U.S. EPA, 2010b, ProUCL, Version 4.00.05, June, Downloaded from <http://www.epa.gov/esd/tsc/software.htm>.
- U.S. EPA, 2011, Polychlorinated Biphenyls – U.S. EPA Conditional Approval Under 40 CFR 761.61(c), Toxic Substances Control Act – “Polychlorinated Biphenyls Notification Plan, Former Pechiney Cast Plate, Inc., Facility, Vernon, California, July 9, 2009,” Letter from Jeff Scott, Director, Waste Management Division, to Donald Thompson, President Pechiney Cast Plate, July 1.
- U.S. Fish and Wildlife Service, email communication from Mr. William B. Miller to Mr. Todd Bernhardt of AMEC Geomatrix on February 1, 2010 regarding a Request for Threatened and Endangered Species List
- United States Salinity Laboratory, 2000, ROSETTA (version 2.1), Agricultural Research Service, United States Department of Agriculture, November.
- URS Corporation (URS), 2002, Report of Soil Removal Activities, Detrex Solvent Division Facility, Vernon, California, April 2.
- URS, 2006, June 2006 Groundwater Monitoring Report, Former Alcoa Vernon Works, 5401 Alcoa Avenue, Vernon, California, July 21.
- Van den Berg, M., et al., 2006, The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds, Toxicological Sciences, 93(2): 223-241, October.
- Water Replenishment District of Southern California, <<http://www.wrd.org>>.

## TABLES

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TABLE 1

**SUMMARY OF RISK-BASED SCREENING LEVELS<sup>1</sup> FOR CHEMICALS OF  
POTENTIAL CONCERN IN SOIL**

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Compound   | RBSL in milligrams per kilogram (mg/kg) |           |                                      |           |
|--|---|-----------|--------------------------------------|-----------|
|  | Construction Worker                     |           | Outdoor Commercial/Industrial Worker |           |
|  | Cancer                                  | Noncancer | Cancer                               | Noncancer |
| <b>Polychlorinated Biphenyls (PCBs)</b>  |   |           |                                      |           |
| <i>Aroclors</i>  |   |           |                                      |           |
| Aroclor-1016   | 3.5E+00                                 | 6.9E+00   | 5.3E-01                              | 2.6E+01   |
| Aroclor-1232   | 3.5E+00                                 | --        | 5.3E-01                              | --        |
| Aroclor-1248   | 3.5E+00                                 | --        | 5.3E-01                              | --        |
| Aroclor-1254   | 3.5E+00                                 | 2.0E+00   | 5.3E-01                              | 7.5E+00   |
| Aroclor-1260   | 3.5E+00                                 | --        | 5.3E-01                              | --        |
| <i>Dioxin-like PCB Congeners</i>   |   |           |                                      |           |
| PCB 77   | 5.3E-01                                 | 1.0E+00   | 8.1E-02                              | 3.8E+00   |
| PCB 81   | 1.8E-01                                 | 3.4E-01   | 2.7E-02                              | 1.3E+00   |
| PCB 105  | 1.8E+00                                 | 3.4E+00   | 2.7E-01                              | 1.3E+01   |
| PCB 114  | 1.8E+00                                 | 3.4E+00   | 2.7E-01                              | 1.3E+01   |
| PCB 118  | 1.8E+00                                 | 3.4E+00   | 2.7E-01                              | 1.3E+01   |
| PCB 123  | 1.8E+00                                 | 3.4E+00   | 2.7E-01                              | 1.3E+01   |
| PCB 126  | 5.3E-04                                 | 1.0E-03   | 8.1E-05                              | 3.8E-03   |
| PCB 156, 157   | 1.8E+00                                 | 3.4E+00   | 2.7E-01                              | 1.3E+01   |
| PCB 167  | 1.8E+00                                 | 3.4E+00   | 2.7E-01                              | 1.3E+01   |
| PCB 169  | 1.8E-03                                 | 3.4E-03   | 2.7E-04                              | 1.3E-02   |
| PCB 189  | 1.8E+00                                 | 3.4E+00   | 2.7E-01                              | 1.3E+01   |
| Dioxin-like PCB congeners (TEQ)  | 5.3E-05                                 | 1.0E-04   | 8.1E-06                              | 3.8E-04   |
| <b>Metals</b>  |   |           |                                      |           |
| Arsenic  | 7.1E+00                                 | 1.6E+01   | 1.3E+00                              | 2.1E+02   |
| Barium   | NC                                      | 7.2E+02   | NC                                   | 1.6E+05   |
| Cadmium  | 2.4E+01                                 | 2.5E+01   | 1.8E+03                              | 5.0E+02   |
| Chromium (total)   | 8.5E+00                                 | 3.9E+05   | 6.4E+02                              | 1.4E+06   |
| Cobalt   | 1.1E+01                                 | 7.9E+00   | 8.5E+02                              | 2.7E+02   |
| Copper   | NC                                      | 1.0E+04   | NC                                   | 3.7E+04   |
| Lead <sup>2</sup>  | 9.4E+02                                 |           | 3.2E+02                              |           |
| Mercury  | --                                      | 2.1E+01   | --                                   | 1.4E+02   |
| Molybdenum   | --                                      | 1.3E+03   | --                                   | 4.6E+03   |
| Nickel   | 3.9E+02                                 | 7.2E+01   | 3.0E+04                              | 1.8E+04   |
| Silver   | NC                                      | 1.3E+03   | NC                                   | 4.6E+03   |
| Thallium   | --                                      | 1.7E+01   | --                                   | 6.0E+01   |
| Vanadium   | --                                      | 1.8E+03   | --                                   | 6.4E+03   |
| Zinc   | NC                                      | 7.8E+04   | NC                                   | 2.8E+05   |
| <b>Total Petroleum Hydrocarbons (TPH)<sup>3</sup> - Apportion Method RBSLs</b> |   |           |                                      |           |
| TPH as gasoline  | --                                      | 6.9E+03   | --                                   | 2.5E+04   |
| TPH as diesel  | --                                      | 6.1E+04   | --                                   | 2.7E+05   |
| TPH as motor oil   | --                                      | 2.0E+05   | --                                   | 7.2E+05   |
| TPH as Stoddard solvent  | --                                      | 9.0E+03   | --                                   | 3.3E+04   |
| TEPH   | --                                      | 8.7E+04   | --                                   | 4.2E+05   |
| c6-c10 hydrocarbons  | --                                      | 6.9E+03   | --                                   | 2.5E+04   |
| c10-c20 hydrocarbons   | --                                      | 3.4E+04   | --                                   | 1.4E+05   |
| c10-c28 hydrocarbons   | --                                      | 7.3E+04   | --                                   | 3.4E+05   |
| c21-c28 hydrocarbons   | --                                      | 1.7E+05   | --                                   | 6.3E+05   |

TABLE 1

**SUMMARY OF RISK-BASED SCREENING LEVELS<sup>1</sup> FOR CHEMICALS OF  
POTENTIAL CONCERN IN SOIL**

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Compound   | RBSL in milligrams per kilogram (mg/kg) |           |                                      |           |
|--|---|-----------|--------------------------------------|-----------|
|  | Construction Worker                     |           | Outdoor Commercial/Industrial Worker |           |
|  | Cancer                                  | Noncancer | Cancer                               | Noncancer |
| <b>Total Petroleum Hydrocarbons (TPH)<sup>3</sup> - Worst Case RBSLs</b> |   |           |                                      |           |
| TPH as gasoline  | --                                      | 2.9E+03   | --                                   | 1.1E+04   |
| TPH as diesel  | --                                      | 6.6E+03   | --                                   | 2.5E+04   |
| TPH as motor oil   | --                                      | 1.3E+05   | --                                   | 4.9E+05   |
| TPH as Stoddard solvent  | --                                      | 2.9E+03   | --                                   | 1.1E+04   |
| TEPH   | --                                      | 6.6E+03   | --                                   | 2.5E+04   |
| c6-c10 hydrocarbons  | --                                      | 2.9E+03   | --                                   | 1.1E+04   |
| c10-c20 hydrocarbons   | --                                      | 6.6E+03   | --                                   | 2.5E+04   |
| c10-c28 hydrocarbons   | --                                      | 6.6E+03   | --                                   | 2.5E+04   |
| c21-c28 hydrocarbons   | --                                      | 1.3E+05   | --                                   | 4.9E+05   |
| <b>Volatile Organic Compounds (VOCs)<sup>3</sup></b>                     |   |           |                                      |           |
| Acetone  | --                                      | 1.2E+05   | --                                   | 4.3E+05   |
| Benzene  | 9.1E+01                                 | 5.2E+02   | 1.3E+01                              | 1.9E+03   |
| n-Butylbenzene   | --                                      | 5.2E+03   | --                                   | 1.9E+04   |
| sec-Butylbenzene   | --                                      | 5.2E+03   | --                                   | 1.9E+04   |
| Ethylbenzene   | 8.3E+02                                 | 1.3E+04   | 1.2E+02                              | 4.8E+04   |
| Isopropylbenzene   | NC                                      | 1.3E+04   | NC                                   | 4.8E+04   |
| Isopropyltoluene   | NC                                      | 1.3E+04   | NC                                   | 4.8E+04   |
| Naphthalene  | --                                      | 2.6E+03   | --                                   | 9.6E+03   |
| n-Propylbenzene  | --                                      | 5.2E+03   | --                                   | 1.9E+04   |
| Tetrachloroethene (PCE)  | 1.7E+01                                 | 1.3E+03   | 2.5E+00                              | 4.8E+03   |
| Toluene  | --                                      | 1.0E+04   | --                                   | 3.8E+04   |
| Trichloroethene (TCE)  | 1.5E+03                                 | 3.9E+01   | 2.3E+02                              | 1.4E+02   |
| 1,2,4-Trimethylbenzene   | --                                      | 6.5E+03   | --                                   | 2.4E+04   |
| 1,3,5-Trimethylbenzene   | --                                      | 6.5E+03   | --                                   | 2.4E+04   |
| Total Xylenes  | --                                      | 2.6E+04   | --                                   | 9.6E+04   |
| m/p-Xylenes  | --                                      | 2.6E+04   | --                                   | 9.6E+04   |
| o-Xylene   | --                                      | 2.6E+04   | --                                   | 9.6E+04   |

**Notes:**

1. Calculation of risk-based screening levels (RBSLs) presented in Appendix C.
2. RBSLs developed for lead based on blood-lead levels, not probability of increased cancer risk or noncancer hazard quotient.
3. Inhalation pathways not incorporated into the development of RBSLs for volatile total petroleum hydrocarbon (TPH) mixtures and volatile organic compounds (VOC). Volatilization of chemicals from the subsurface to ambient or indoor air evaluated using soil vapor measurements and RBSLs developed for this data (Table 3).

**Abbreviations:**

NC = noncarcinogenic  
RBSL = risk-based screening level  
TEQ = Toxic Equivalent  
-- = not applicable

**TABLE 2**

**SUMMARY OF RISK-BASED SCREENING LEVELS<sup>1</sup> FOR CHEMICALS  
OF POTENTIAL CONCERN IN GROUNDWATER**

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Compound   | RBSL in micrograms per liter (µg/L)                             |           |
|--|---|-----------|
|  | Indoor Commercial/Industrial Worker -<br>Exposure to Indoor Air |           |
|  | Cancer  | Noncancer |
| <b>Total Petroleum Hydrocarbons (TPH) - Apportion Method RBSLs</b> |   |           |
| TPH as gasoline  | --  | 1.5E+03   |
| <b>Total Petroleum Hydrocarbons (TPH) - Worst Case RBSLs</b>       |   |           |
| TPH as gasoline  | --  | 6.8E+02   |
| <b>Volatile Organic Compounds (VOCs)</b>                           |   |           |
| Benzene  | 2.1E+01   | 1.3E+04   |
| Chloroform   | 1.4E+02   | 8.2E+04   |
| 1,1-Dichloroethene   | --  | 3.0E+03   |
| 1,2-Dichloroethane   | 1.4E+02   | --        |
| Dichloromethane  | 1.3E+03   | 1.9E+05   |
| Ethylbenzene   | 2.0E+02   | 3.7E+05   |
| Tetrachloroethene (PCE)  | 3.8E+01   | 2.8E+03   |
| Toluene  | --  | 5.5E+04   |
| Trichloroethene (TCE)  | 1.8E+02   | 7.8E+04   |
| m/p-Xylenes  | --  | 1.3E+05   |
| o-Xylene   | --  | 1.7E+05   |

Note:

1. Calculation of risk-based screening levels presented in Appendix C.

Abbreviations:

NC = noncarcinogenic

RBSL = risk-based screening level

-- = not applicable



TABLE 3

**SUMMARY OF RISK-BASED SCREENING LEVELS<sup>1</sup> FOR CHEMICALS OF  
POTENTIAL CONCERN IN SOIL VAPOR**

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Compound   | RBSL in micrograms per liter (µg/L)                 |           |  |           |   |           |
|--|---|-----------|--|-----------|---|-----------|
|  | Construction Worker -<br>Exposure to Ambient<br>Air |           | Outdoor<br>Commercial/Industrial<br>Worker -<br>Exposure to Ambient<br>Air |           | Indoor<br>Commercial/Industrial<br>Worker -<br>Exposure to Indoor Air |           |
|  |   |           |  |           |   |           |
|  | Cancer  | Noncancer | Cancer   | Noncancer | Cancer  | Noncancer |
| <b>Total Petroleum Hydrocarbons (TPH) - Apportion Method RBSLs</b> |   |           |  |           |   |           |
| TPH as Stoddard solvent  | --  | 8.0E+04   | --   | 5.5E+05   | --  | 1.5E+03   |
| <b>Total Petroleum Hydrocarbons (TPH) - Worst Case RBSLs</b>       |   |           |  |           |   |           |
| TPH as Stoddard solvent  | --  | 1.2E+04   | --   | 8.9E+04   | --  | 6.8E+02   |
| <b>Volatile Organic Compounds (VOCs)</b>                           |   |           |  |           |   |           |
| Chloroform   | 2.8E+03   | 6.4E+04   | 7.9E+02  | 4.6E+05   | 2.0E+00   | 1.1E+03   |
| 1,2-Dichloroethane   | 5.3E+02   | 3.8E+05   | 1.5E+02  | 2.7E+06   | 5.2E-01   | 9.1E+03   |
| 1,1-Dichloroethene   | --  | 2.9E+04   | --   | 2.1E+05   | --  | 2.9E+02   |
| cis-1,2-Dichloroethene   | NC  | 9.7E+03   | NC   | 6.9E+04   | NC  | 1.6E+02   |
| Naphthalene  | 3.5E+01   | 1.5E+02   | 1.0E+01  | 1.1E+03   | 4.4E-01   | 4.9E+01   |
| Tetrachloroethene (PCE)  | 3.5E+03   | 1.1E+04   | 1.0E+03  | 7.6E+04   | 2.2E+00   | 1.7E+02   |
| Toluene  | --  | 4.9E+04   | --   | 3.5E+05   | --  | 1.3E+03   |
| 1,1,1-Trichloroethane  | NC  | 1.6E+06   | NC   | 1.1E+07   | NC  | 2.3E+04   |
| Trichloroethene (TCE)  | 7.7E+03   | 1.3E+05   | 2.2E+03  | 9.4E+05   | 6.3E+00   | 2.7E+03   |
| 1,2,4-Trimethylbenzene   | --  | 5.1E+02   | --   | 3.6E+03   | --  | 3.7E+01   |
| 1,3,5-Trimethylbenzene   | --  | 4.3E+02   | --   | 3.1E+03   | --  | 3.2E+01   |
| m/p-Xylenes  | --  | 9.2E+04   | --   | 6.6E+05   | --  | 3.2E+03   |
| o-Xylene   | --  | 7.4E+04   | --   | 5.3E+05   | --  | 3.0E+03   |

**Note:**

1. Calculation of risk-based screening levels presented in Appendix C.

**Abbreviations:**

NC = noncarcinogenic

RBSL = risk-based screening level

-- = not applicable

TABLE 4

COMPARISON OF MAXIMUM SOIL CONCENTRATIONS TO RISK-BASED SCREENING LEVELS -  
PHASE I AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                      | Maximum Concentration (mg/kg) | Outdoor Commercial/Industrial Worker |                   |                 |                 | Construction Worker |                   |                 |                 |
|-------------------------------|-------------------------------|--------------------------------------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|-----------------|
|                               |                               | Soil RBSL                            |                   | Predicted Risks |                 | Soil RBSL           |                   | Predicted Risks |                 |
|                               |                               | Cancer (mg/kg)                       | Noncancer (mg/kg) | Risk            | Hazard Quotient | Cancer (mg/kg)      | Noncancer (mg/kg) | Risk            | Hazard Quotient |
| Aroclor-1016                  | 0.25                          | 5.3E-01                              | 2.6E+01           | 4.7E-07         | 9.5E-03         | 3.5E+00             | 6.9E+00           | 7.2E-08         | 3.6E-02         |
| Aroclor-1248                  | 1000                          | 5.3E-01                              | --                | 1.9E-03         | --              | 3.5E+00             | --                | 2.9E-04         | --              |
| Aroclor-1260                  | 13                            | 5.3E-01                              | --                | 2.5E-05         | --              | 3.5E+00             | --                | 3.8E-06         | --              |
| Cadmium                       | 1.4                           | 1.8E+03                              | 5.0E+02           | 7.8E-10         | 2.8E-03         | 2.4E+01             | 2.5E+01           | 5.9E-08         | 5.7E-02         |
| Copper                        | 75                            | NC                                   | 3.7E+04           | --              | 2.0E-03         | NC                  | 1.0E+04           | --              | 7.3E-03         |
| Mercury                       | 0.23                          | --                                   | 1.4E+02           | --              | 1.6E-03         | --                  | 2.1E+01           | --              | 1.1E-02         |
| Zinc                          | 430                           | NC                                   | 2.8E+05           | --              | 1.6E-03         | NC                  | 7.8E+04           | --              | 5.5E-03         |
| TPH as diesel                 | 107                           | --                                   | 2.7E+05           | --              | 3.9E-04         | --                  | 6.1E+04           | --              | 1.8E-03         |
| TPH as motor oil              | 464                           | --                                   | 7.2E+05           | --              | 6.4E-04         | --                  | 2.0E+05           | --              | 2.4E-03         |
| Ethylbenzene                  | 0.0045                        | 1.2E+02                              | 4.8E+04           | 3.7E-11         | 9.4E-08         | 8.3E+02             | 1.3E+04           | 5.4E-12         | 3.5E-07         |
| Tetrachloroethene (PCE)       | 0.0084                        | 2.5E+00                              | 4.8E+03           | 3.4E-09         | 1.8E-06         | 1.7E+01             | 1.3E+03           | 5.0E-10         | 6.5E-06         |
| Toluene                       | 0.0085                        | --                                   | 3.8E+04           | --              | 2.2E-07         | --                  | 1.0E+04           | --              | 8.2E-07         |
| Trichloroethene (TCE)         | 0.12                          | 2.3E+02                              | 1.4E+02           | 5.3E-10         | 8.4E-04         | 1.5E+03             | 3.9E+01           | 7.8E-11         | 3.1E-03         |
| m/p-Xylenes                   | 0.0225                        | --                                   | 9.6E+04           | --              | 2.4E-07         | --                  | 2.6E+04           | --              | 8.7E-07         |
| Cumulative Risk/Hazard Index  |                               |                                      |                   | 2E-03           | 0.02            |                     |                   | 3E-04           | 0.12            |
| TPH - Worst Case Calculations |                               |                                      |                   |                 |                 |                     |                   |                 |                 |
| TPH as diesel                 | 107                           | --                                   | 2.5E+04           | --              | 4.3E-03         | --                  | 6.6E+03           | --              | 1.6E-02         |
| TPH as motor oil              | 464                           | --                                   | 4.9E+05           | --              | 9.5E-04         | --                  | 1.3E+05           | --              | 3.5E-03         |

Note:

Chemicals contributing a cancer risk level greater than  $1 \times 10^{-6}$  or a hazard quotient of 1 for either receptor are **bold**.

Abbreviations:

NC = noncarcinogenic

mg/kg = milligrams per kilogram

RBSL = risk-based screening level

-- = not applicable

TPH = total petroleum hydrocarbons

TABLE 5

COMPARISON OF MAXIMUM SOIL CONCENTRATIONS TO RISK-BASED SCREENING LEVELS -  
PHASE II AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                      | Maximum Concentration (mg/kg) | Outdoor Commercial/Industrial Worker |                   |                 |                 | Construction Worker |                   |                 |                 |
|-------------------------------|-------------------------------|--------------------------------------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|-----------------|
|                               |                               | Soil RBSL                            |                   | Predicted Risks |                 | Soil RBSL           |                   | Predicted Risks |                 |
|                               |                               | Cancer (mg/kg)                       | Noncancer (mg/kg) | Risk            | Hazard Quotient | Cancer (mg/kg)      | Noncancer (mg/kg) | Risk            | Hazard Quotient |
| Aroclor-1016                  | 0.038                         | 5.3E-01                              | 2.6E+01           | 7.2E-08         | 1.4E-03         | 3.5E+00             | 6.9E+00           | 1.1E-08         | 5.5E-03         |
| Aroclor-1232                  | 0.61                          | 5.3E-01                              | --                | 1.2E-06         | --              | 3.5E+00             | --                | 1.8E-07         | --              |
| Aroclor-1248                  | 1900                          | 5.3E-01                              | --                | 3.6E-03         | --              | 3.5E+00             | --                | 5.5E-04         | --              |
| Aroclor-1254                  | 19                            | 5.3E-01                              | 7.5E+00           | 3.6E-05         | 2.5E+00         | 3.5E+00             | 2.0E+00           | 5.5E-06         | 9.6E+00         |
| Aroclor-1260                  | 60                            | 5.3E-01                              | --                | 1.1E-04         | --              | 3.5E+00             | --                | 1.7E-05         | --              |
| Chromium (total)              | 32.1                          | 6.4E+02                              | 1.4E+06           | 5.0E-08         | 2.3E-05         | 8.5E+00             | 3.9E+05           | 3.8E-06         | 8.3E-05         |
| Copper                        | 193                           | NC                                   | 3.7E+04           | --              | 5.3E-03         | NC                  | 1.0E+04           | --              | 1.9E-02         |
| Zinc                          | 607                           | NC                                   | 2.8E+05           | --              | 2.2E-03         | NC                  | 7.8E+04           | --              | 7.8E-03         |
| TPH as diesel                 | 401.1                         | --                                   | 2.7E+05           | --              | 1.5E-03         | --                  | 6.1E+04           | --              | 6.6E-03         |
| TPH as motor oil              | 1,216.4                       | --                                   | 7.2E+05           | --              | 1.7E-03         | --                  | 2.0E+05           | --              | 6.2E-03         |
| TEPH                          | 1,100                         | --                                   | 4.2E+05           | --              | 2.6E-03         | --                  | 8.7E+04           | --              | 1.3E-02         |
| Toluene                       | 0.0021                        | --                                   | 3.8E+04           | --              | 5.5E-08         | --                  | 1.0E+04           | --              | 2.0E-07         |
| Total Xylenes                 | 0.006                         | --                                   | 9.6E+04           | --              | 6.3E-08         | --                  | 2.6E+04           | --              | 2.3E-07         |
| Cumulative Risk/Hazard Index  |                               |                                      |                   | 4E-03           | 3               |                     |                   | 6E-04           | 10              |
| TPH - Worst Case Calculations |                               |                                      |                   |                 |                 |                     |                   |                 |                 |
| TPH as diesel                 | 401.1                         | --                                   | 2.5E+04           | --              | 1.6E-02         | --                  | 6.6E+03           | --              | 6.1E-02         |
| TPH as motor oil              | 1,216.4                       | --                                   | 4.9E+05           | --              | 2.5E-03         | --                  | 1.3E+05           | --              | 9.2E-03         |
| TEPH                          | 1,100                         | --                                   | 2.5E+04           | --              | 4.4E-02         | --                  | 6.6E+03           | --              | 1.7E-01         |

Note:

Chemicals contributing a cancer risk level greater than  $1 \times 10^{-6}$  or a hazard quotient of 1 for either receptor are **bold**.

Abbreviations:

NC = noncarcinogenic  
mg/kg = milligrams per kilogram  
RBSL = risk-based screening level  
-- = not applicable  
TPH = total petroleum hydrocarbons

TABLE 6

COMPARISON OF MAXIMUM SOIL CONCENTRATIONS TO RISK-BASED SCREENING LEVELS -  
PHASE IIIa AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                      | Maximum Concentration (mg/kg) | Outdoor Commercial/Industrial Worker |                   |                 |                 | Construction Worker |                   |                 |                 |
|-------------------------------|-------------------------------|--------------------------------------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|-----------------|
|                               |                               | Soil RBSL                            |                   | Predicted Risks |                 | Soil RBSL           |                   | Predicted Risks |                 |
|                               |                               | Cancer (mg/kg)                       | Noncancer (mg/kg) | Risk            | Hazard Quotient | Cancer (mg/kg)      | Noncancer (mg/kg) | Risk            | Hazard Quotient |
| Aroclor-1248                  | 20                            | 5.3E-01                              | --                | 3.8E-05         | --              | 3.5E+00             | --                | 5.8E-06         | --              |
| Aroclor-1254                  | 5.2                           | 5.3E-01                              | 7.5E+00           | 9.8E-06         | 6.9E-01         | 3.5E+00             | 2.0E+00           | 1.5E-06         | 2.6E+00         |
| Aroclor-1260                  | 0.86                          | 5.3E-01                              | --                | 1.6E-06         | --              | 3.5E+00             | --                | 2.5E-07         | --              |
| Arsenic                       | 60                            | 1.3E+00                              | 2.1E+02           | 4.6E-05         | 2.9E-01         | 7.1E+00             | 1.6E+01           | 8.5E-06         | 3.7E+00         |
| Copper                        | 257                           | NC                                   | 3.7E+04           | --              | 7.0E-03         | NC                  | 1.0E+04           | --              | 2.5E-02         |
| Mercury                       | 0.43                          | --                                   | 1.4E+02           | --              | 3.0E-03         | --                  | 2.1E+01           | --              | 2.1E-02         |
| Molybdenum                    | 5                             | --                                   | 4.6E+03           | --              | 1.1E-03         | --                  | 1.3E+03           | --              | 3.9E-03         |
| Silver                        | 5                             | NC                                   | 4.6E+03           | --              | 1.1E-03         | NC                  | 1.3E+03           | --              | 3.9E-03         |
| Zinc                          | 187                           | NC                                   | 2.8E+05           | --              | 6.8E-04         | NC                  | 7.8E+04           | --              | 2.4E-03         |
| TPH as diesel                 | 30                            | --                                   | 2.7E+05           | --              | 1.1E-04         | --                  | 6.1E+04           | --              | 5.0E-04         |
| TPH as motor oil              | 182                           | --                                   | 7.2E+05           | --              | 2.5E-04         | --                  | 2.0E+05           | --              | 9.3E-04         |
| c10-c20 hydrocarbons          | 7,000                         | --                                   | 1.4E+05           | --              | 5.1E-02         | --                  | 3.4E+04           | --              | 2.1E-01         |
| c10-c28 hydrocarbons          | 280                           | --                                   | 3.4E+05           | --              | 8.1E-04         | --                  | 7.3E+04           | --              | 3.8E-03         |
| c21-c28 hydrocarbons          | 42,000                        | --                                   | 6.3E+05           | --              | 6.7E-02         | --                  | 1.7E+05           | --              | 2.5E-01         |
| Cumulative Risk/Hazard Index  |                               |                                      |                   | 1E-04           | 1               |                     |                   | 2E-05           | 7               |
| TPH - Worst Case Calculations |                               |                                      |                   |                 |                 |                     |                   |                 |                 |
| TPH as diesel                 | 30                            | --                                   | 2.5E+04           | --              | 1.2E-03         | --                  | 6.6E+03           | --              | 4.6E-03         |
| TPH as motor oil              | 182                           | --                                   | 4.9E+05           | --              | 3.7E-04         | --                  | 1.3E+05           | --              | 1.4E-03         |
| c10-c20 hydrocarbons          | 7,000                         | --                                   | 2.5E+04           | --              | 2.8E-01         | --                  | 6.6E+03           | --              | 1.1E+00         |
| c10-c28 hydrocarbons          | 280                           | --                                   | 2.5E+04           | --              | 1.1E-02         | --                  | 6.6E+03           | --              | 4.3E-02         |
| c21-c28 hydrocarbons          | 42,000                        | --                                   | 4.9E+05           | --              | 8.6E-02         | --                  | 1.3E+05           | --              | 3.2E-01         |

Note:

Chemicals contributing a cancer risk level greater than  $1 \times 10^{-6}$  or a hazard quotient of 1 for either receptor are **bold**.

Abbreviations:

NC = noncarcinogenic  
mg/kg = milligrams per kilogram  
RBSL = risk-based screening level  
-- = not applicable  
TPH = total petroleum hydrocarbons

TABLE 7

COMPARISON OF MAXIMUM SOIL CONCENTRATIONS TO RISK-BASED SCREENING LEVELS -  
PHASE IIIb AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                      | Maximum Concentration (mg/kg) | Outdoor Commercial/Industrial Worker |                   |                 |                 | Construction Worker |                   |                 |                 |
|-------------------------------|-------------------------------|--------------------------------------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|-----------------|
|                               |                               | Soil RBSL                            |                   | Predicted Risks |                 | Soil RBSL           |                   | Predicted Risks |                 |
|                               |                               | Cancer (mg/kg)                       | Noncancer (mg/kg) | Risk            | Hazard Quotient | Cancer (mg/kg)      | Noncancer (mg/kg) | Risk            | Hazard Quotient |
| c6-c10 hydrocarbons           | 17,000                        | --                                   | 2.5E+04           | --              | 6.7E-01         | --                  | 6.9E+03           | --              | 2.5E+00         |
| c10-c28 hydrocarbons          | 13,000                        | --                                   | 3.4E+05           | --              | 3.8E-02         | --                  | 7.3E+04           | --              | 1.8E-01         |
| Benzene                       | 3.8                           | 1.3E+01                              | 1.9E+03           | 2.8E-07         | 2.0E-03         | 9.1E+01             | 5.2E+02           | 4.2E-08         | 7.3E-03         |
| Ethylbenzene                  | 7.6                           | 1.2E+02                              | 4.8E+04           | 6.3E-08         | 1.6E-04         | 8.3E+02             | 1.3E+04           | 9.2E-09         | 5.8E-04         |
| Xylenes (total)               | 62                            | --                                   | 9.6E+04           | --              | 6.5E-04         | --                  | 2.6E+04           | --              | 2.4E-03         |
| Cumulative Risk/Hazard Index  |                               |                                      |                   | 3E-07           | 1               |                     |                   | 5E-08           | 3               |
| TPH - Worst Case Calculations |                               |                                      |                   |                 |                 |                     |                   |                 |                 |
| c6-c10 hydrocarbons           | 17,000                        | --                                   | 1.1E+04           | --              | 1.6E+00         | --                  | 2.9E+03           | --              | 5.9E+00         |
| c10-c28 hydrocarbons          | 13,000                        | --                                   | 2.5E+04           | --              | 5.2E-01         | --                  | 6.6E+03           | --              | 2.0E+00         |

Note:

Chemicals contributing a cancer risk level greater than  $1 \times 10^{-6}$  or a hazard quotient of 1 for any receptor are **bold**.

Abbreviations:

mg/kg = milligrams per kilogram

RBSL = risk-based screening level

-- = not applicable

TPH = total petroleum hydrocarbons

TABLE 8

COMPARISON OF MAXIMUM SOIL CONCENTRATIONS TO RISK-BASED SCREENING LEVELS -  
PHASE IV AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                   | Maximum Concentration (mg/kg) | Outdoor Commercial/Industrial Worker |                   |                 |                 | Construction Worker |                   |                 |                 |
|----------------------------|-------------------------------|--------------------------------------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|-----------------|
|                            |                               | Soil RBSL                            |                   | Predicted Risks |                 | Soil RBSL           |                   | Predicted Risks |                 |
|                            |                               | Cancer (mg/kg)                       | Noncancer (mg/kg) | Risk            | Hazard Quotient | Cancer (mg/kg)      | Noncancer (mg/kg) | Risk            | Hazard Quotient |
| Aroclor-1232               | 0.47                          | 5.3E-01                              | --                | 8.9E-07         | --              | 3.5E+00             | --                | 1.4E-07         | --              |
| <b>Aroclor-1248</b>        | 0.68                          | 5.3E-01                              | --                | <b>1.3E-06</b>  | --              | 3.5E+00             | --                | 2.0E-07         | --              |
| <b>Aroclor-1254</b>        | 2.3                           | 5.3E-01                              | 7.5E+00           | <b>4.4E-06</b>  | 3.0E-01         | 3.5E+00             | 2.0E+00           | 6.6E-07         | <b>1.2E+00</b>  |
| <b>Aroclor-1260</b>        | 1.2                           | 5.3E-01                              | --                | <b>2.3E-06</b>  | --              | 3.5E+00             | --                | 3.5E-07         | --              |
| <b>Arsenic</b>             | 120                           | 1.3E+00                              | 2.1E+02           | <b>9.2E-05</b>  | 5.7E-01         | 7.1E+00             | 1.6E+01           | <b>1.7E-05</b>  | <b>7.5E+00</b>  |
| Barium                     | 190                           | NC                                   | 1.6E+05           | --              | 1.2E-03         | NC                  | 7.2E+02           | --              | 2.6E-01         |
| Cadmium                    | 2.8                           | 1.8E+03                              | 5.0E+02           | 1.6E-09         | 5.6E-03         | 2.4E+01             | 2.5E+01           | 1.2E-07         | 1.1E-01         |
| <b>Cobalt</b>              | 16                            | 8.5E+02                              | 2.7E+02           | 1.9E-08         | 5.9E-02         | 1.1E+01             | 7.9E+00           | <b>1.4E-06</b>  | <b>2.0E+00</b>  |
| Copper                     | 76                            | NC                                   | 3.7E+04           | --              | 2.1E-03         | NC                  | 1.0E+04           | --              | 7.4E-03         |
| Mercury                    | 0.98                          | --                                   | 1.4E+02           | --              | 6.9E-03         | --                  | 2.1E+01           | --              | 4.7E-02         |
| Nickel                     | 27                            | 3.0E+04                              | 1.8E+04           | 9.1E-10         | 1.5E-03         | 3.9E+02             | 7.2E+01           | 6.9E-08         | 3.7E-01         |
| Thallium                   | 1.2                           | --                                   | 6.0E+01           | --              | 2.0E-02         | --                  | 1.7E+01           | --              | 7.1E-02         |
| Vanadium                   | 59                            | --                                   | 6.4E+03           | --              | 9.2E-03         | --                  | 1.8E+03           | --              | 3.3E-02         |
| Zinc                       | 110                           | NC                                   | 2.8E+05           | --              | 4.0E-04         | NC                  | 7.8E+04           | --              | 1.4E-03         |
| TPH as gasoline            | 420                           | --                                   | 2.5E+04           | --              | 1.7E-02         | --                  | 6.9E+03           | --              | 6.1E-02         |
| TPH as diesel              | 365                           | --                                   | 2.7E+05           | --              | 1.3E-03         | --                  | 6.1E+04           | --              | 6.0E-03         |
| TPH as motor oil           | 185                           | --                                   | 7.2E+05           | --              | 2.6E-04         | --                  | 2.0E+05           | --              | 9.4E-04         |
| TPH as Stoddard solvent    | 890                           | --                                   | 3.3E+04           | --              | 2.7E-02         | --                  | 9.0E+03           | --              | 9.9E-02         |
| <b>c6-c10 hydrocarbons</b> | 26,000                        | --                                   | 2.5E+04           | --              | 1.0E+00         | --                  | 6.9E+03           | --              | <b>3.8E+00</b>  |
| c10-c20 hydrocarbons       | 14,000                        | --                                   | 1.4E+05           | --              | 1.0E-01         | --                  | 3.4E+04           | --              | 4.1E-01         |
| c10-c28 hydrocarbons       | 37,000                        | --                                   | 3.4E+05           | --              | 1.1E-01         | --                  | 7.3E+04           | --              | 5.1E-01         |
| c21-c28 hydrocarbons       | 300                           | --                                   | 6.3E+05           | --              | 4.8E-04         | --                  | 1.7E+05           | --              | 1.8E-03         |
| Acetone                    | 0.085                         | --                                   | 4.3E+05           | --              | 2.0E-07         | --                  | 1.2E+05           | --              | 7.3E-07         |
| Benzene                    | 3.1                           | 1.3E+01                              | 1.9E+03           | 2.3E-07         | 1.6E-03         | 9.1E+01             | 5.2E+02           | 3.4E-08         | 6.0E-03         |
| n-Butylbenzene             | 28                            | --                                   | 1.9E+04           | --              | 1.5E-03         | --                  | 5.2E+03           | --              | 5.4E-03         |
| sec-Butylbenzene           | 15                            | --                                   | 1.9E+04           | --              | 7.9E-04         | --                  | 5.2E+03           | --              | 2.9E-03         |
| Ethylbenzene               | 31                            | 1.2E+02                              | 4.8E+04           | 2.6E-07         | 6.5E-04         | 8.3E+02             | 1.3E+04           | 3.7E-08         | 2.4E-03         |
| Isopropylbenzene           | 0.85                          | NC                                   | 4.8E+04           | --              | 1.8E-05         | NC                  | 1.3E+04           | --              | 6.5E-05         |
| Isopropyltoluene           | 32                            | NC                                   | 4.8E+04           | --              | 6.7E-04         | NC                  | 1.3E+04           | --              | 2.5E-03         |
| Naphthalene                | 5.4                           | --                                   | 9.6E+03           | --              | 5.7E-04         | --                  | 2.6E+03           | --              | 2.1E-03         |
| n-Propylbenzene            | 6.2                           | --                                   | 1.9E+04           | --              | 3.2E-04         | --                  | 5.2E+03           | --              | 1.2E-03         |
| Toluene                    | 10                            | --                                   | 3.8E+04           | --              | 2.6E-04         | --                  | 1.0E+04           | --              | 9.6E-04         |
| 1,2,4-Trimethylbenzene     | 100                           | --                                   | 2.4E+04           | --              | 4.2E-03         | --                  | 6.5E+03           | --              | 1.5E-02         |



TABLE 8

COMPARISON OF MAXIMUM SOIL CONCENTRATIONS TO RISK-BASED SCREENING LEVELS -  
PHASE IV AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                      | Maximum Concentration (mg/kg) | Outdoor Commercial/Industrial Worker |                   |                 |                 | Construction Worker |                   |                 |                 |
|-------------------------------|-------------------------------|--------------------------------------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|-----------------|
|                               |                               | Soil RBSL                            |                   | Predicted Risks |                 | Soil RBSL           |                   | Predicted Risks |                 |
|                               |                               | Cancer (mg/kg)                       | Noncancer (mg/kg) | Risk            | Hazard Quotient | Cancer (mg/kg)      | Noncancer (mg/kg) | Risk            | Hazard Quotient |
| 1,3,5-Trimethylbenzene        | 30                            | --                                   | 2.4E+04           | --              | 1.3E-03         | --                  | 6.5E+03           | --              | 4.6E-03         |
| Xylenes (total)               | 160                           | --                                   | 9.6E+04           | --              | 1.7E-03         | --                  | 2.6E+04           | --              | 6.2E-03         |
| Cumulative Risk/Hazard Index  |                               |                                      |                   | 1E-04           | 2               |                     |                   | 2E-05           | 16              |
| TPH - Worst Case Calculations |                               |                                      |                   |                 |                 |                     |                   |                 |                 |
| TPH as gasoline               | 420                           | --                                   | 1.1E+04           | --              | 4.0E-02         | --                  | 2.9E+03           | --              | 1.5E-01         |
| TPH as diesel                 | 365                           | --                                   | 2.5E+04           | --              | 1.5E-02         | --                  | 6.6E+03           | --              | 5.5E-02         |
| TPH as motor oil              | 185                           | --                                   | 4.9E+05           | --              | 3.8E-04         | --                  | 1.3E+05           | --              | 1.4E-03         |
| TPH as Stoddard solvent       | 890                           | --                                   | 1.1E+04           | --              | 8.5E-02         | --                  | 2.9E+03           | --              | 3.1E-01         |
| c6-c10 hydrocarbons           | 26,000                        | --                                   | 1.1E+04           | --              | 2.5E+00         | --                  | 2.9E+03           | --              | 9.1E+00         |
| c10-c20 hydrocarbons          | 14,000                        | --                                   | 2.5E+04           | --              | 5.6E-01         | --                  | 6.6E+03           | --              | 2.1E+00         |
| c10-c28 hydrocarbons          | 37,000                        | --                                   | 2.5E+04           | --              | 1.5E+00         | --                  | 6.6E+03           | --              | 5.6E+00         |
| c21-c28 hydrocarbons          | 300                           | --                                   | 4.9E+05           | --              | 6.2E-04         | --                  | 1.3E+05           | --              | 2.3E-03         |

Note:

Chemicals contributing a cancer risk level greater than  $1 \times 10^{-6}$  or a hazard quotient of 1 for any receptor are **bold**.

Abbreviations:

NC = noncarcinogenic  
mg/kg = milligrams per kilogram  
RBSL = risk-based screening level  
-- = not applicable  
TPH = total petroleum hydrocarbons

TABLE 9

COMPARISON OF MAXIMUM SOIL CONCENTRATIONS TO RISK-BASED SCREENING LEVELS -  
PHASE V AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                      | Maximum Concentration (mg/kg) | Outdoor Commercial/Industrial Worker |                   |                 |                 | Construction Worker |                   |                 |                 |
|-------------------------------|-------------------------------|--------------------------------------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|-----------------|
|                               |                               | Soil RBSL                            |                   | Predicted Risks |                 | Soil RBSL           |                   | Predicted Risks |                 |
|                               |                               | Cancer (mg/kg)                       | Noncancer (mg/kg) | Risk            | Hazard Quotient | Cancer (mg/kg)      | Noncancer (mg/kg) | Risk            | Hazard Quotient |
| Cadmium                       | 0.54                          | 1.8E+03                              | 5.0E+02           | 3.0E-10         | 1.1E-03         | 2.4E+01             | 2.5E+01           | 2.3E-08         | 2.2E-02         |
| Zinc                          | 138                           | NC                                   | 2.8E+05           | --              | 5.0E-04         | NC                  | 7.8E+04           | --              | 1.8E-03         |
| c10-c28 hydrocarbons          | 540                           | --                                   | 3.4E+05           | --              | 1.6E-03         | --                  | 7.3E+04           | --              | 7.4E-03         |
| Cumulative Risk/Hazard Index  |                               |                                      |                   | 3E-10           | 0.003           |                     |                   | 2E-08           | 0.03            |
| TPH - Worst Case Calculations |                               |                                      |                   |                 |                 |                     |                   |                 |                 |
| c10-c28 hydrocarbons          | 540                           | --                                   | 2.5E+04           | --              | 2.2E-02         | --                  | 6.6E+03           | --              | 8.2E-02         |

Note:

Chemicals contributing a cancer risk level greater than  $1 \times 10^{-6}$  or a hazard quotient of 1 for any receptor are **bold**.

Abbreviations:

NC = noncarcinogenic

mg/kg = milligrams per kilogram

RBSL = risk-based screening level

-- = not applicable

TPH = total petroleum hydrocarbons

TABLE 10

COMPARISON OF MAXIMUM SOIL CONCENTRATIONS TO RISK-BASED SCREENING LEVELS -  
PHASE VI AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                      | Maximum Concentration (mg/kg) | Outdoor Commercial/Industrial Worker |                   |                 |                 | Construction Worker |                   |                 |                 |
|-------------------------------|-------------------------------|--------------------------------------|-------------------|-----------------|-----------------|---------------------|-------------------|-----------------|-----------------|
|                               |                               | Soil RBSL                            |                   | Predicted Risks |                 | Soil RBSL           |                   | Predicted Risks |                 |
|                               |                               | Cancer (mg/kg)                       | Noncancer (mg/kg) | Risk            | Hazard Quotient | Cancer (mg/kg)      | Noncancer (mg/kg) | Risk            | Hazard Quotient |
| Aroclor-1248                  | 0.14                          | 5.3E-01                              | --                | 2.7E-07         | --              | 3.5E+00             | --                | 4.0E-08         | --              |
| <b>Aroclor-1260</b>           | 0.57                          | 5.3E-01                              | --                | <b>1.1E-06</b>  | --              | 3.5E+00             | --                | 1.6E-07         | --              |
| <b>Arsenic</b>                | 74                            | 1.3E+00                              | 2.1E+02           | <b>5.7E-05</b>  | 3.5E-01         | 7.1E+00             | 1.6E+01           | <b>1.0E-05</b>  | <b>4.6E+00</b>  |
| Mercury                       | 0.4                           | --                                   | 1.4E+02           | --              | 2.8E-03         | --                  | 2.1E+01           | --              | 1.9E-02         |
| Nickel                        | 24.5                          | 3.0E+04                              | 1.8E+04           | 8.3E-10         | 1.4E-03         | 3.9E+02             | 7.2E+01           | 6.2E-08         | 3.4E-01         |
| Zinc                          | 145                           | NC                                   | 2.8E+05           | --              | 5.3E-04         | NC                  | 7.8E+04           | --              | 1.9E-03         |
| c10-c28 hydrocarbons          | 280                           | --                                   | 3.4E+05           | --              | 8.1E-04         | --                  | 7.3E+04           | --              | 3.8E-03         |
| Cumulative Risk/Hazard Index  |                               |                                      |                   | 6E-05           | 0.4             |                     |                   | 1E-05           | 5               |
| TPH - Worst Case Calculations |                               |                                      |                   |                 |                 |                     |                   |                 |                 |
| c10-c28 hydrocarbons          | 280                           | --                                   | 2.5E+04           | --              | 1.1E-02         | --                  | 6.6E+03           | --              | 4.3E-02         |

Note:

Chemicals contributing a cancer risk level greater than  $1 \times 10^{-6}$  or a hazard quotient of 1 for either receptor are **bold**.

Abbreviations:

NC = noncarcinogenic

mg/kg = milligrams per kilogram

RBSL = risk-based screening level

-- = not applicable

TPH = total petroleum hydrocarbons

**TABLE 11**

**SUMMARY OF MAXIMUM PREDICTED LIFETIME EXCESS CANCER RISKS  
AND NONCANCER HAZARD INDEXES - SOIL EXPOSURE**

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Area       | Cancer Risks                               |                        | Noncancer HIs                              |                        |
|------------|--|------------------------|--|------------------------|
|            | Outdoor<br>Commercial/Industrial<br>Worker | Construction<br>Worker | Outdoor<br>Commercial/Industrial<br>Worker | Construction<br>Worker |
| Phase I    | 2E-03                                      | 3E-04                  | 0.02                                       | 0.1                    |
| Phase II   | 4E-03                                      | 6E-04                  | 3  | 10                     |
| Phase IIIa | 1E-04                                      | 2E-05                  | 1  | 7                      |
| Phase IIIb | 3E-07                                      | 5E-08                  | 0.7  | 3                      |
| Phase IV   | 1E-04                                      | 2E-05                  | 2  | 16                     |
| Phase V    | 3E-10                                      | 2E-08                  | 0.003                                      | 0.03                   |
| Phase VI   | 6E-05                                      | 1E-05                  | 0.4  | 5                      |

Abbreviation:

HI = hazard index

TABLE 12

COMPARISON OF MAXIMUM GROUNDWATER CONCENTRATIONS TO RISK-BASED SCREENING LEVELS - SITE-WIDE

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                             | Maximum Concentration (µg/L) | Indoor Commercial/Industrial Worker |                  |                 |                 |
|--------------------------------------|------------------------------|-------------------------------------|------------------|-----------------|-----------------|
|                                      |                              | Groundwater RBSL                    |                  | Predicted Risks |                 |
|                                      |                              | Cancer (µg/L)                       | Noncancer (µg/L) | Risk            | Hazard Quotient |
| Benzene                              | 3.3                          | 2.1E+01                             | 1.3E+04          | 1.6E-07         | 2.6E-04         |
| Chloroform                           | 105                          | 1.4E+02                             | 8.2E+04          | 7.3E-07         | 1.3E-03         |
| 1,1-Dichloroethene                   | 1.2                          | --                                  | 3.0E+03          | --              | 4.0E-04         |
| <b>1,2-Dichloroethane</b>            | 410                          | 1.4E+02                             | --               | <b>3.0E-06</b>  | --              |
| Dichloromethane                      | 10                           | 1.3E+03                             | 1.9E+05          | 7.7E-09         | 5.4E-05         |
| Ethylbenzene                         | 14                           | 2.0E+02                             | 3.7E+05          | 6.8E-08         | 3.8E-05         |
| Tetrachloroethene (PCE)              | 4.6                          | 3.8E+01                             | 2.8E+03          | 1.2E-07         | 1.6E-03         |
| Toluene                              | 29                           | --                                  | 5.5E+04          | --              | 5.2E-04         |
| TPH as gasoline                      | 870                          | --                                  | 1.5E+03          | --              | 5.8E-01         |
| <b>Trichloroethene (TCE)</b>         | 420                          | 1.8E+02                             | 7.8E+04          | <b>2.3E-06</b>  | 5.4E-03         |
| m/p-Xylenes                          | 56                           | --                                  | 1.3E+05          | --              | 4.4E-04         |
| o-Xylene                             | 25                           | --                                  | 1.7E+05          | --              | 1.5E-04         |
| <b>Cumulative Risk/Hazard Index</b>  |                              |                                     |                  | 6E-06           | 0.6             |
| <b>TPH - Worst Case Calculations</b> |                              |                                     |                  |                 |                 |
| <b>TPH as gasoline</b>               | 870                          | --                                  | 6.8E+02          | --              | <b>1.3E+00</b>  |

Note:

Chemicals contributing a cancer risk level greater than  $1 \times 10^{-6}$  or a hazard quotient of 1 for any receptor are **bold**.

Abbreviations:

µg/L = micrograms per liter

RBSL = risk-based screening level

-- = not applicable

TPH = total petroleum hydrocarbons

TABLE 13

COMPARISON OF MAXIMUM SOIL VAPOR CONCENTRATIONS TO RISK-BASED SCREENING LEVELS -  
PHASE I AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                      | Maximum Concentration (µg/L) | Indoor Commercial/Industrial Worker |                  |                 |                 | Outdoor Commercial/Industrial Worker |                  |                 |                 | Construction Worker |                  |                 |                 |
|-------------------------------|------------------------------|-------------------------------------|------------------|-----------------|-----------------|--------------------------------------|------------------|-----------------|-----------------|---------------------|------------------|-----------------|-----------------|
|                               |                              | Soil Vapor RBSL                     |                  | Predicted Risks |                 | Soil Vapor RBSL                      |                  | Predicted Risks |                 | Soil Vapor RBSL     |                  | Predicted Risks |                 |
|                               |                              | Cancer (µg/L)                       | Noncancer (µg/L) | Risk            | Hazard Quotient | Cancer (µg/L)                        | Noncancer (µg/L) | Risk            | Hazard Quotient | Cancer (µg/L)       | Noncancer (µg/L) | Risk            | Hazard Quotient |
| Chloroform                    | 2.5                          | 2.0E+00                             | 1.1E+03          | 1.3E-06         | 2.2E-03         | 7.9E+02                              | 4.6E+05          | 3.2E-09         | 5.5E-06         | 2.8E+03             | 6.4E+04          | 9.1E-10         | 3.9E-05         |
| 1,1-Dichloroethene            | 22                           | --                                  | 2.9E+02          | --              | 7.6E-02         | --                                   | 2.1E+05          | --              | 1.1E-04         | --                  | 2.9E+04          | --              | 7.5E-04         |
| Tetrachloroethene (PCE)       | 120                          | 2.2E+00                             | 1.7E+02          | 5.4E-05         | 7.2E-01         | 1.0E+03                              | 7.6E+04          | 1.2E-07         | 1.6E-03         | 3.5E+03             | 1.1E+04          | 3.4E-08         | 1.1E-02         |
| Toluene                       | 4.7                          | --                                  | 1.3E+03          | --              | 3.7E-03         | --                                   | 3.5E+05          | --              | 1.3E-05         | --                  | 4.9E+04          | --              | 9.5E-05         |
| TPH as Stoddard solvent       | 18                           | --                                  | 1.5E+03          | --              | 1.2E-02         | --                                   | 5.5E+05          | --              | 3.3E-05         | --                  | 8.0E+04          | --              | 2.3E-04         |
| 1,1,1-Trichloroethane         | 13                           | NC                                  | 2.3E+04          | --              | 5.8E-04         | NC                                   | 1.1E+07          | --              | 1.1E-06         | NC                  | 1.6E+06          | --              | 8.1E-06         |
| Trichloroethene (TCE)         | 1900                         | 6.3E+00                             | 2.7E+03          | 3.0E-04         | 7.1E-01         | 2.2E+03                              | 9.4E+05          | 8.7E-07         | 2.0E-03         | 7.7E+03             | 1.3E+05          | 2.5E-07         | 1.4E-02         |
| m,p-Xylenes                   | 2                            | --                                  | 3.2E+03          | --              | 6.3E-04         | --                                   | 6.6E+05          | --              | 3.0E-06         | --                  | 9.2E+04          | --              | 2.2E-05         |
| Cumulative Risk/Hazard Index  |                              |                                     |                  | 4E-04           | 2               |                                      |                  |                 | 1E-06           | 0.004               |                  |                 |                 |
| TPH - Worst Case Calculations |                              |                                     |                  |                 |                 |                                      |                  |                 |                 |                     |                  |                 |                 |
| TPH as Stoddard solvent       | 18                           | --                                  | 6.8E+02          | --              | 2.6E-02         | --                                   | 8.9E+04          | --              | 2.0E-04         | --                  | 1.2E+04          | --              | 1.5E-03         |

Note:

Chemicals contributing a cancer risk level greater than  $1 \times 10^{-6}$  or a hazard quotient of 1 for any receptor are **bold**.

Abbreviations:

NC = noncarcinogenic

µg/L = micrograms per liter

RBSL = risk-based screening level

-- = not applicable

TPH = total petroleum hydrocarbons



TABLE 14

COMPARISON OF MAXIMUM SOIL VAPOR CONCENTRATIONS TO RISK-BASED SCREENING LEVELS -  
PHASE II AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                     | Maximum Concentration (µg/L) | Indoor Commercial/Industrial Worker |                  |                 |                 | Outdoor Commercial/Industrial Worker |                  |                 |                 | Construction Worker |                  |                 |                 |
|------------------------------|------------------------------|-------------------------------------|------------------|-----------------|-----------------|--------------------------------------|------------------|-----------------|-----------------|---------------------|------------------|-----------------|-----------------|
|                              |                              | Soil Vapor RBSL                     |                  | Predicted Risks |                 | Soil Vapor RBSL                      |                  | Predicted Risks |                 | Soil Vapor RBSL     |                  | Predicted Risks |                 |
|                              |                              | Cancer (µg/L)                       | Noncancer (µg/L) | Risk            | Hazard Quotient | Cancer (µg/L)                        | Noncancer (µg/L) | Risk            | Hazard Quotient | Cancer (µg/L)       | Noncancer (µg/L) | Risk            | Hazard Quotient |
| Tetrachloroethene (PCE)      | 0.53                         | 2.2E+00                             | 1.7E+02          | 2.4E-07         | 3.2E-03         | 1.0E+03                              | 7.6E+04          | 5.3E-10         | 7.0E-06         | 3.5E+03             | 1.1E+04          | 1.5E-10         | 5.0E-05         |
| Trichloroethene (TCE)        | 2.4                          | 6.3E+00                             | 2.7E+03          | 3.8E-07         | 8.9E-04         | 2.2E+03                              | 9.4E+05          | 1.1E-09         | 2.6E-06         | 7.7E+03             | 1.3E+05          | 3.1E-10         | 1.8E-05         |
| Cumulative Risk/Hazard Index |                              |                                     |                  | 6E-07           | 0.004           |                                      |                  | 2E-09           | 1E-05           |                     |                  | 5E-10           | 7E-05           |

Abbreviations:

µg/L = micrograms per liter

RBSL = risk-based screening level

TABLE 15

COMPARISON OF MAXIMUM SOIL VAPOR CONCENTRATIONS TO RISK-BASED SCREENING LEVELS-  
PHASE IIIb AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                      | Maximum Concentration (µg/L) | Indoor Commercial/Industrial Worker |                  |                 |                 | Outdoor Commercial/Industrial Worker |                  |                 |                 | Construction Worker |                  |                 |                 |   |
|-------------------------------|------------------------------|-------------------------------------|------------------|-----------------|-----------------|--------------------------------------|------------------|-----------------|-----------------|---------------------|------------------|-----------------|-----------------|---|
|                               |                              | Soil Vapor RBSL                     |                  | Predicted Risks |                 | Soil Vapor RBSL                      |                  | Predicted Risks |                 | Soil Vapor RBSL     |                  | Predicted Risks |                 |   |
|                               |                              | Cancer (µg/L)                       | Noncancer (µg/L) | Risk            | Hazard Quotient | Cancer (µg/L)                        | Noncancer (µg/L) | Risk            | Hazard Quotient | Cancer (µg/L)       | Noncancer (µg/L) | Risk            | Hazard Quotient |   |
| 1,2-Dichloroethane            | 0.12                         | 5.2E-01                             | 9.1E+03          | 2.3E-07         | 1.3E-05         | 1.5E+02                              | 2.7E+06          | 7.9E-10         | 4.5E-08         | 5.3E+02             | 3.8E+05          | 2.3E-10         | 3.2E-07         |   |
| Tetrachloroethene (PCE)       | 0.15                         | 2.2E+00                             | 1.7E+02          | 6.8E-08         | 9.0E-04         | 1.0E+03                              | 7.6E+04          | 1.5E-10         | 2.0E-06         | 3.5E+03             | 1.1E+04          | 4.2E-11         | 1.4E-05         |   |
| TPH as Stoddard solvent       | 60,000                       | --                                  | 1.5E+03          | --              | 4.0E+01         | --                                   | 5.5E+05          | --              | 1.1E-01         | --                  | 8.0E+04          | --              | 7.5E-01         |   |
| 1,2,4-Trimethylbenzene        | 360                          | --                                  | 3.7E+01          | --              | 9.7E+00         | --                                   | 3.6E+03          | --              | 9.9E-02         | --                  | 5.1E+02          | --              | 7.0E-01         |   |
| 1,3,5-Trimethylbenzene        | 120                          | --                                  | 3.2E+01          | --              | 3.7E+00         | --                                   | 3.1E+03          | --              | 3.9E-02         | --                  | 4.3E+02          | --              | 2.8E-01         |   |
| m,p-Xylenes                   | 0.12                         | --                                  | 3.2E+03          | --              | 3.8E-05         | --                                   | 6.6E+05          | --              | 1.8E-07         | --                  | 9.2E+04          | --              | 1.3E-06         |   |
| Cumulative Risk/Hazard Index  |                              |                                     |                  | 3E-07           | 53              |                                      |                  |                 | 9E-10           | 0.2                 |                  |                 | 3E-10           | 2 |
| TPH - Worst Case Calculations |                              |                                     |                  |                 |                 |                                      |                  |                 |                 |                     |                  |                 |                 |   |
| TPH as Stoddard solvent       | 60,000                       | --                                  | 6.8E+02          | --              | 8.8E+01         | --                                   | 8.9E+04          | --              | 6.7E-01         | --                  | 1.2E+04          | --              | 5.0E+00         |   |

Note:

Chemicals contributing a cancer risk level greater than  $1 \times 10^{-6}$  or a hazard quotient of 1 for any receptor are **bold**.

Abbreviations:

µg/L = micrograms per liter

RBSL = risk-based screening level

-- = not applicable

TPH = total petroleum hydrocarbons

TABLE 16

COMPARISON OF MAXIMUM SOIL VAPOR CONCENTRATIONS TO RISK-BASED SCREENING LEVELS-  
PHASE IV AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                      | Maximum Concentration (µg/L) | Indoor Commercial/Industrial Worker |                  |                 |                 | Outdoor Commercial/Industrial Worker |                  |                 |                 | Construction Worker |                  |                 |                 |
|-------------------------------|------------------------------|-------------------------------------|------------------|-----------------|-----------------|--------------------------------------|------------------|-----------------|-----------------|---------------------|------------------|-----------------|-----------------|
|                               |                              | Soil Vapor RBSL                     |                  | Predicted Risks |                 | Soil Vapor RBSL                      |                  | Predicted Risks |                 | Soil Vapor RBSL     |                  | Predicted Risks |                 |
|                               |                              | Cancer (µg/L)                       | Noncancer (µg/L) | Risk            | Hazard Quotient | Cancer (µg/L)                        | Noncancer (µg/L) | Risk            | Hazard Quotient | Cancer (µg/L)       | Noncancer (µg/L) | Risk            | Hazard Quotient |
| Naphthalene                   | 0.083                        | 4.4E-01                             | 4.9E+01          | 1.9E-07         | 1.7E-03         | 1.0E+01                              | 1.1E+03          | 8.3E-09         | 7.5E-05         | 3.5E+01             | 1.5E+02          | 2.4E-09         | 5.4E-04         |
| Tetrachloroethene (PCE)       | 0.27                         | 2.2E+00                             | 1.7E+02          | 1.2E-07         | 1.6E-03         | 1.0E+03                              | 7.6E+04          | 2.7E-10         | 3.6E-06         | 3.5E+03             | 1.1E+04          | 7.6E-11         | 2.5E-05         |
| TPH as Stoddard solvent       | 42,000                       | --                                  | 1.5E+03          | --              | 2.8E+01         | --                                   | 5.5E+05          | --              | 7.6E-02         | --                  | 8.0E+04          | --              | 5.3E-01         |
| Trichloroethene (TCE)         | 0.19                         | 6.3E+00                             | 2.7E+03          | 3.0E-08         | 7.1E-05         | 2.2E+03                              | 9.4E+05          | 8.7E-11         | 2.0E-07         | 7.7E+03             | 1.3E+05          | 2.5E-11         | 1.4E-06         |
| 1,2,4-Trimethylbenzene        | 280                          | --                                  | 3.7E+01          | --              | 7.5E+00         | --                                   | 3.6E+03          | --              | 7.7E-02         | --                  | 5.1E+02          | --              | 5.5E-01         |
| 1,3,5-Trimethylbenzene        | 70                           | --                                  | 3.2E+01          | --              | 2.2E+00         | --                                   | 3.1E+03          | --              | 2.3E-02         | --                  | 4.3E+02          | --              | 1.6E-01         |
| m,p-Xylenes                   | 44                           | --                                  | 3.2E+03          | --              | 1.4E-02         | --                                   | 6.6E+05          | --              | 6.7E-05         | --                  | 9.2E+04          | --              | 4.8E-04         |
| o-Xylene                      | 27                           | --                                  | 3.0E+03          | --              | 9.1E-03         | --                                   | 5.3E+05          | --              | 5.1E-05         | --                  | 7.4E+04          | --              | 3.6E-04         |
| Cumulative Risk/Hazard Index  |                              |                                     |                  | 3E-07           | 38              |                                      |                  | 9E-09           | 0.2             |                     |                  | 2E-09           | 1               |
| TPH - Worst Case Calculations |                              |                                     |                  |                 |                 |                                      |                  |                 |                 |                     |                  |                 |                 |
| TPH as Stoddard solvent       | 42,000                       | --                                  | 6.8E+02          | --              | 6.2E+01         | --                                   | 8.9E+04          | --              | 4.7E-01         | --                  | 1.2E+04          | --              | 3.5E+00         |

Note:

Chemicals contributing a cancer risk level greater than  $1 \times 10^{-6}$  or a hazard quotient of 1 for any receptor are **bold**.

Abbreviations:

µg/L = micrograms per liter

RBSL = risk-based screening level

-- = not applicable

TPH = total petroleum hydrocarbons

TABLE 17

COMPARISON OF MAXIMUM SOIL VAPOR CONCENTRATIONS TO RISK-BASED SCREENING LEVELS -  
PHASE V AREA

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Chemical                     | Maximum Concentration (µg/L) | Indoor Commercial/Industrial Worker |                  |                 |                 | Outdoor Commercial/Industrial Worker |                  |                 |                 | Construction Worker |                  |                 |                 |
|------------------------------|------------------------------|-------------------------------------|------------------|-----------------|-----------------|--------------------------------------|------------------|-----------------|-----------------|---------------------|------------------|-----------------|-----------------|
|                              |                              | Soil Vapor RBSL                     |                  | Predicted Risks |                 | Soil Vapor RBSL                      |                  | Predicted Risks |                 | Soil Vapor RBSL     |                  | Predicted Risks |                 |
|                              |                              | Cancer (µg/L)                       | Noncancer (µg/L) | Risk            | Hazard Quotient | Cancer (µg/L)                        | Noncancer (µg/L) | Risk            | Hazard Quotient | Cancer (µg/L)       | Noncancer (µg/L) | Risk            | Hazard Quotient |
| Tetrachloroethene (PCE)      | 0.22                         | 2.2E+00                             | 1.7E+02          | 9.9E-08         | 1.3E-03         | 1.0E+03                              | 7.6E+04          | 2.2E-10         | 2.9E-06         | 3.5E+03             | 1.1E+04          | 6.2E-11         | 2.1E-05         |
| Toluene                      | 0.51                         | --                                  | 1.3E+03          | --              | 4.0E-04         | --                                   | 3.5E+05          | --              | 1.5E-06         | --                  | 4.9E+04          | --              | 1.0E-05         |
| m,p-Xylenes                  | 0.48                         | --                                  | 3.2E+03          | --              | 1.5E-04         | --                                   | 6.6E+05          | --              | 7.3E-07         | --                  | 9.2E+04          | --              | 5.2E-06         |
| Cumulative Risk/Hazard Index |                              |                                     |                  | 1E-07           | 0.002           |                                      |                  | 2E-10           | 5E-06           |                     |                  | 6E-11           | 4E-05           |

Abbreviations:

µg/L = micrograms per liter

RBSL = risk-based screening level

-- = not applicable

**TABLE 18**

**SUMMARY OF MAXIMUM PREDICTED LIFETIME EXCESS CANCER RISKS  
AND NONCANCER HAZARD INDEXES - SOIL VAPOR EXPOSURE**

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Area       | Cancer Risks                              |  |                        | Noncancer HIs                             |  |                        |
|------------|---|--|------------------------|---|--|------------------------|
|            | Indoor<br>Commercial/Industrial<br>Worker | Outdoor<br>Commercial/Industrial<br>Worker | Construction<br>Worker | Indoor<br>Commercial/Industrial<br>Worker | Outdoor<br>Commercial/Industrial<br>Worker | Construction<br>Worker |
| Phase I    | 4E-04                                     | 1E-06                                      | 3E-07                  | 2   | 0.004                                      | 0.03                   |
| Phase II   | 6E-07                                     | 2E-09                                      | 5E-10                  | 0.004                                     | 1E-05                                      | 7E-05                  |
| Phase IIIa | -- <sup>1</sup>                           | -- <sup>1</sup>                            | -- <sup>1</sup>        | -- <sup>1</sup>                           | -- <sup>1</sup>                            | -- <sup>1</sup>        |
| Phase IIIb | 3E-07                                     | 9E-10                                      | 3E-10                  | 53  | 0.2  | 2                      |
| Phase IV   | 3E-07                                     | 9E-09                                      | 2E-09                  | 38  | 0.2  | 1.2                    |
| Phase V    | 1E-07                                     | 2E-10                                      | 6E-11                  | 0.002                                     | 5E-06                                      | 4E-05                  |
| Phase VI   | -- <sup>2</sup>                           | -- <sup>2</sup>                            | -- <sup>2</sup>        | -- <sup>2</sup>                           | -- <sup>2</sup>                            | -- <sup>2</sup>        |

Notes:

1. No volatile organic compounds (VOCs) were detected in soil vapor in the Phase IIIa area.
2. No soil vapor samples collected in the Phase VI area.

Abbreviations:

HI = hazard index  
-- = not applicable

TABLE 19

**SUMMARY OF MAXIMUM PREDICTED LIFETIME EXCESS CANCER RISKS  
AND NONCANCER HAZARD INDEXES - CUMULATIVE SOIL AND SOIL VAPOR EXPOSURE**

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Area       | Cancer Risks                              |  |                        | Noncancer HIs                             |  |                        |
|------------|---|--|------------------------|---|--|------------------------|
|            | Indoor<br>Commercial/Industrial<br>Worker | Outdoor<br>Commercial/Industrial<br>Worker | Construction<br>Worker | Indoor<br>Commercial/Industrial<br>Worker | Outdoor<br>Commercial/Industrial<br>Worker | Construction<br>Worker |
| Phase I    | <b>4E-04</b>                              | <b>2E-03</b>                               | <b>3E-04</b>           | <b>2</b>                                  | 0.02                                       | 0.2                    |
| Phase II   | 6E-07                                     | <b>4E-03</b>                               | <b>6E-04</b>           | 0.004                                     | <b>3</b>                                   | <b>10</b>              |
| Phase IIIa | -- <sup>1</sup>                           | <b>1E-04</b>                               | <b>2E-05</b>           | -- <sup>1</sup>                           | 1  | <b>7</b>               |
| Phase IIIb | 3E-07                                     | 3E-07                                      | 5E-08                  | <b>53</b>                                 | 1  | <b>4</b>               |
| Phase IV   | 3E-07                                     | <b>1E-04</b>                               | <b>2E-05</b>           | <b>38</b>                                 | <b>2</b>                                   | <b>18</b>              |
| Phase V    | 1E-07                                     | 5E-10                                      | 2E-08                  | 0.002                                     | 0.003                                      | 0.03                   |
| Phase VI   | -- <sup>1</sup>                           | <b>6E-05</b>                               | <b>1E-05</b>           | -- <sup>1</sup>                           | 0.4  | <b>5</b>               |

Notes:

1. Cancer risks and HIs above DTSC points of departure (a cumulative lifetime excess cancer risk of  $1 \times 10^{-6}$ ; an HI of 1) are **bold**.
2. No volatile organic compounds (VOCs) were detected in soil or soil vapor in the Phase IIIa and Phase VI areas.

Abbreviations:

HI = hazard index

-- = not applicable



**TABLE 20**

**COMPARISON OF MAXIMUM SOIL CONCENTRATIONS TO  
RISK-BASED SCREENING LEVELS - LEAD**

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Area       | Lead Maximum<br>Concentration<br>(mg/kg) | Outdoor<br>Commercial/Industrial<br>Worker |                         | Construction Worker |                         |
|------------|--|--|-------------------------|---------------------|-------------------------|
|            |  | Screening<br>Level                         | Risk Ratio <sup>1</sup> | Screening<br>Level  | Risk Ratio <sup>1</sup> |
| Phase I    | 34 <sup>2</sup>                          | 320  | --                      | 940                 | --                      |
| Phase II   | 82                                       | 320  | 2.6E-01                 | 940                 | 8.7E-02                 |
| Phase IIIa | 157                                      | 320  | 4.9E-01                 | 940                 | 1.7E-01                 |
| Phase IIIb | 12 <sup>2</sup>                          | 320  | --                      | 940                 | --                      |
| Phase IV   | 55                                       | 320  | 1.7E-01                 | 940                 | 5.9E-02                 |
| Phase V    | 28.8 <sup>2</sup>                        | 320  | --                      | 940                 | --                      |
| Phase VI   | 23.4 <sup>2</sup>                        | 320  | --                      | 940                 | --                      |

Notes:

1. Ratio of lead concentration to risk-based screening level.
2. Below 48.5 mg/kg, the site-specific background concentration for lead established as described in Appendix B.

Abbreviations:

mg/kg = milligrams per kilogram  
-- = not applicable

TABLE 21

SOIL SCREENING LEVELS FOR SELECTED VOCs FOR THE PROTECTION OF GROUNDWATER<sup>1</sup>

Former Pechiney Cast Plate, Inc. Facility

Vernon, California

| Depth<br>(Feet) | Concentration in micrograms per kilogram (µg/kg) <sup>2</sup> |                            |         |         |              |         |                    |                      |                        |                      |                      |                     |                            |                            |
|-----------------|---|----------------------------|---------|---------|--------------|---------|--------------------|----------------------|------------------------|----------------------|----------------------|---------------------|----------------------------|----------------------------|
|                 | Trichloroethene<br>(TCE)                                      | Tetrachloroethene<br>(PCE) | Benzene | Toluene | Ethylbenzene | Xylenes | n-Butyl<br>benzene | sec-Butyl<br>benzene | 1,2-<br>Dichloroethane | Isopropyl<br>benzene | Isopropyl<br>toluene | n-Propyl<br>benzene | 1,2,4-<br>Trimethylbenzene | 1,3,5-<br>Trimethylbenzene |
| 1               | 152   | 764                        | 15      | 9058    | 15,349       | 97,239  | 169,622            | 128,949              | 1.8                    | 39,451               | 594,541              | 169,622             | 282,856                    | 62,394                     |
| 10              | 145   | 732                        | 15      | 8670    | 14,690       | 93,069  | 162,348            | 123,419              | 1.7                    | 37,759               | 569,046              | 162,348             | 270,726                    | 59,718                     |
| 20              | 138   | 694                        | 14      | 8227    | 13,940       | 88,314  | 154,053            | 117,113              | 1.6                    | 35,830               | 539,969              | 154,053             | 256,893                    | 56,667                     |
| 30              | 130   | 655                        | 13      | 7769    | 13,164       | 83,398  | 145,478            | 110,594              | 1.5                    | 33,836               | 509,913              | 145,478             | 242,593                    | 53,513                     |
| 40              | 122   | 615                        | 12      | 7292    | 12,356       | 78,278  | 136,547            | 103,804              | 1.4                    | 31,758               | 478,609              | 136,547             | 227,700                    | 50,227                     |
| 50              | 114   | 572                        | 11      | 6777    | 11,484       | 72,756  | 126,914            | 96,482               | 1.3                    | 29,518               | 444,847              | 126,914             | 211,638                    | 46,684                     |
| 60              | 80  | 404                        | 8       | 4790    | 8116         | 51,415  | 89,688             | 68,182               | 0.9                    | 20,860               | 314,365              | 89,688              | 149,561                    | 32,991                     |
| 70              | 60  | 301                        | 6       | 3565    | 6040         | 38,267  | 66,753             | 50,746               | 0.7                    | 15,526               | 233,975              | 66,753              | 111,315                    | 24,554                     |
| 80              | 52  | 260                        | 5       | 3081    | 5220         | 33,071  | 57,688             | 43,855               | 0.6                    | 13,417               | 202,202              | 57,688              | 96,199                     | 21,220                     |
| 90              | 36  | 183                        | 4       | 2164    | 3667         | 23,230  | 40,521             | 30,805               | 0.5                    | 9425                 | 142,031              | 40,521              | 67,572                     | 14,905                     |
| 100             | 27  | 138                        | 3       | 1634    | 2768         | 17,538  | 30,593             | 23,257               | 0.5                    | 7115                 | 107,232              | 30,593              | 51,016                     | 11,253                     |
| 110             | 12  | 59                         | 1       | 702     | 1190         | 7536    | 13,146             | 9993                 | 0.5                    | 3057                 | 46,076               | 13,146              | 21,921                     | 4835                       |
| 120             | 9   | 44                         | 1       | 530     | 900          | 5694    | 9819               | 7467                 | 0.5                    | 2312                 | 34,411               | 9819                | 16,370                     | 3621                       |
| 130             | 5   | 19                         | 1       | 229     | 391          | 2466    | 4159               | 3165                 | 0.5                    | 1004                 | 14,571               | 4159                | 6930                       | 1542                       |
| 140             | 5   | 10                         | 1       | 150     | 300          | 1750    | 2144               | 1635                 | 0.5                    | 770                  | 7504                 | 2144                | 3567                       | 807                        |
| 149             | 5   | 5                          | 1       | 150     | 300          | 1750    | 260                | 260                  | 0.5                    | 770                  | 784                  | 260                 | 369                        | 330                        |

Notes:

1. Calculations based on Appendix A, "Attenuation Factor Method For VOCs" of "Remediation Guidance For Petroleum and VOC Impacted Sites" in Interim Site Assessment & Cleanup Guidebook published by the California Regional Water Quality Control Board, Los Angeles Region. Calculations are presented in Appendix D of the FS.
2. In some cases, detection limits were above screening levels.

TABLE 22

**SITE-SPECIFIC REMEDIATION GOALS  
VOCs IN SOIL VAPOR**

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Compound   | Remediation Goal<br>(micrograms per<br>liter; µg/L) | Explanation   |
|--|---|---|
| <b><u>Phase I Area</u></b>                             |   |   |
| Chloroform   | 6.7   | Derived from the Cancer-based RBSL <sup>1</sup> for Indoor Commercial/Industrial Workers (2.0 µg/L). A chloroform concentration of 6.7 µg/L is protective of cumulative indoor commercial/industrial worker exposure to the VOC COCs in the Phase I area, based on a target cancer risk of 10 <sup>-5</sup> .     |
| Tetrachloroethene (PCE)                                | 7.3   | Derived from the Cancer-based RBSL for Indoor Commercial/Industrial Workers (2.2 µg/L). A PCE concentration of 7.3 µg/L is protective of cumulative indoor commercial/industrial worker exposure to the VOC COCs in the Phase I area, based on a target cancer risk of 10 <sup>-5</sup> .                         |
| Trichloroethene (TCE)                                  | 21  | Derived from the Cancer-based RBSL for Indoor Commercial/Industrial Workers (6.3 µg/L). A TCE concentration of 21 µg/L is protective of cumulative indoor commercial/industrial worker exposure to the VOC COCs in the Phase I area, based on a target cancer risk of 10 <sup>-5</sup> .                          |
| <b><u>Phase IIIb and Phase IV Areas</u></b>            |   |   |
| Total Petroleum Hydrocarbons (TPH) as Stoddard solvent | 500   | Derived from the Noncancer-based RBSL for Indoor Commercial/Industrial Workers (1500 µg/L). A Stoddard solvent concentration of 500 µg/L is protective of cumulative indoor commercial/industrial worker exposure to the VOC COCs in the Phase IIIb and Phase IV areas, based on a target hazard index of 1.      |
| 1,2,4-Trimethylbenzene                                 | 12.3  | Derived from the Noncancer-based RBSL for Indoor Commercial/Industrial Workers (37 µg/L). A 1,2,4-trimethylbenzene concentration of 12.3 µg/L is protective of cumulative indoor commercial/industrial worker exposure to the VOC COCs in the Phase IIIb and Phase IV areas, based on a target hazard index of 1. |
| 1,3,5-Trimethylbenzene                                 | 10.7  | Derived from the Noncancer-based RBSL for Indoor Commercial/Industrial Workers (32 µg/L). A 1,3,5-trimethylbenzene concentration of 10.7 µg/L is protective of cumulative indoor commercial/industrial worker exposure to the VOC COCs in the Phase IIIb and Phase IV areas, based on a target hazard index of 1. |

**Note:**

1. RBSL - Risk-Based Screening Level. Developed based on the methodology described in Appendix C, RBSLs were used to conduct the screening-level human health risk assessment (Section 4.0).

TABLE 23

POTENTIAL HUMAN HEALTH RISKS FROM DIOXIN-LIKE PCB CONGENERS VERSUS PCBS AS AROCLOR MIXTURES

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Sample ID   | Dioxin-Like PCB Congeners<br><i>Concentrations reported in picograms per gram (pg/g)</i> |                    |             |         |                |          |         |              |                 |         |         |            | Aroclor Mixtures<br><i>Concentrations reported in micrograms per kilogram (µg/kg)</i> |              |                 |              |              |
|---|--|--------------------|-------------|---------|----------------|----------|---------|--------------|-----------------|---------|---------|------------|---|--------------|-----------------|--------------|--------------|
|   | PCB 77   | PCB 81             | PCB 105     | PCB 114 | PCB 118        | PCB 123  | PCB 126 | PCB 156, 157 | PCB 167         | PCB 169 | PCB 189 | Dioxin TEQ | Aroclor 1016  | Aroclor 1232 | Aroclor 1248    | Aroclor 1254 | Aroclor 1260 |
| Concrete Samples  |  |                    |             |         |                |          |         |              |                 |         |         |            |   |              |                 |              |              |
| B-1-A4  | 4600   | <2171 <sup>1</sup> | 14,600      | <1746   | 25,200 J       | <1546    | <1647   | 1700         | <1000           | <677    | <581    | 94.6       | <20   | <20          | 320             | <20          | 280          |
| C-12-A  | 190 J  | <11.7 UJ           | 825         | <45.5   | 1440           | <39.5    | <52.6   | 143          | 49.0            | <15.9   | 19.9    | 2.96       | <20   | <20          | 110             | <20          | <20          |
| C-14-A  | 131 J  | <29.2 UJ           | 420 J       | <72.4   | 920 J          | <59.9 UJ | <100 UJ | 242          | 98.6            | <53.3   | 45.6    | 5.87       | <20   | <20          | 38              | <20          | 74           |
| DC-22-A   | 1010   | <413               | 3310        | <440    | 7990           | 405      | <339    | 1300         | 1020            | 238     | 535     | 24.7       | <20   | <20          | 39              | <20          | 130          |
| DC-23-A   | 4060   | <1546              | 13,900      | <1109   | 26,200         | <1135    | <842 UJ | 4340         | 2740            | <536    | 1030    | 52.3       | <20   | <20          | 370             | <20          | 810          |
| DC-25-A   | 77.9 J   | <32.6 UJ           | 260         | <46.8   | 389            | <39.3    | <45.1   | <46.6        | 58.0            | <34.8   | 28.5    | 2.81       | <20   | <20          | <20             | <20          | 28           |
| DC-52-A   | 659 J  | <59.3 UJ           | 2220        | 99.3    | 2990           | 104      | <82.4   | 216          | 136             | <50.5   | 41.7    | 5.13       | <20   | <20          | 41              | <20          | 33           |
| DC-154-A  | 119,000  | 4660               | 457,000     | 28,900  | 703,000        | 11,500   | 5960    | 44,700       | 13,200          | <564    | 2630    | 656        | <1000   | <1000        | 12,000          | <1000        | 1400         |
| DC-168-C  | 2,730,000  | 164,000 J          | 10,500,000  | 842,000 | 18,100,000 J,E | 560,000  | 124,000 | 1,530,000    | 509,000         | <37,214 | 302,000 | 14,250     | <20,000   | <20,000      | 390,000         | <20000       | 200,000      |
| Soil Samples  |  |                    |             |         |                |          |         |              |                 |         |         |            |   |              |                 |              |              |
| 175-SS-01   | 51,500   | 3130               | 246,000 J,E | 18,700  | 320,000 J,E    | 7200     | 3450    | 20,900       | 5760            | 252     | 1210    | 377        | <20   | <20          | 3400            | <20          | 500          |
| 176-SS-01   | 102,000 J,E  | 4230               | 322,000 J,E | 23,000  | 446,000 J,E    | 13,400   | 3090    | 22,000       | 6090            | 103     | 937     | 349        | <100  | <100         | 20,000          | <100         | 860          |
| 177-SS-01   | 4080 J,E   | <112               | 9320 J,E    | 503     | 14,200 J,E     | 368      | 85.5    | 464          | 127             | <4.26   | 17.4    | 9.79       | <20   | <20          | 130             | <20          | <20          |
| 178-SS-01   | 11,900   | <698               | 44,200 J,E  | 1060    | 75,200 J,E     | 8030     | <925    | 7250         | 2450            | <216    | 487     | 54.9       | <20   | <20          | 270             | <20          | 180          |
| 179-SS-01   | <1984  | <1837              | 4220        | <1834   | 6710           | <1630    | <1716   | <1470        | <1316           | <1296   | <967    | 106        | <100  | <100         | 130             | <100         | 340          |
| 180-SS-01   | 1020   | 39.5               | 3570 J,E    | 232     | 6250 J,E       | 117      | 79.1 J  | 644          | 163             | <11.4   | 36.1    | 8.53       | <20   | <20          | 65              | <20          | 26           |
| 180-SS-02   | 382  | 16.4               | 1140        | 84.1    | 2150 J         | 50.4     | 17.1    | 128          | 37.3            | <2.64   | 6.30    | 1.90       | <20   | <20          | 160             | <20          | <20          |
| 181-SS-01   | 959  | 43.3               | 3620 J,E    | 253     | 5950 J,E       | 141      | 61.0    | 597          | 191             | 9.68    | 66.7    | 6.82       | <20   | <20          | 54              | 56           | 30           |
| 182-SS-01   | 131,000 J,E  | <15,391            | 565,000 J,E | 25,400  | 1,030,000 J,E  | 22,400   | <8373   | 157,000 J,E  | 56,300 J,E      | <5493   | 23,100  | 573        | <1000   | <1000        | 14,000          | 19,000       | 26,000       |
| 183-SS-01   | 32,200 J,E   | 1160               | 111,000 J,E | 6490    | 169,000 J,E    | 4620     | 1140    | 8740         | 2310            | 49.2    | 516     | 128        | <20   | <20          | 680             | 2300         | 350          |
| 184-SS-01   | 4.18   | <2.37              | 36.6        | <4.33   | 75.4 J         | <3.59    | <4.44   | 28.2         | 9.91            | <4.28   | 2.82    | 0.29       | <20   | <20          | <20             | <20          | <20          |
| 185-SS-01   | 5.74   | <5.18              | 40.2        | 5.85    | 176 J          | 5.74     | <2.72   | 6.58         | <2.77           | <2.39   | 1.25    | 0.18       | <20   | <20          | 190             | <20          | <20          |
| 186-SS-01   | 15.4   | <4.97              | 40.4 J      | <4.58   | 60.9 J         | <4.31    | <4.32   | 5.27         | 1.97            | <1.58   | <1.17   | 0.25       | <20   | <20          | <20             | <20          | <20          |
| 187-SS-01   | <60.1  | <55.0              | 2200 J      | <216    | 2740 J         | <227 UJ  | <306 UJ | 4760         | 1540            | <139    | 176     | 17.7       | <20   | <20          | 47              | <20          | 51           |
| 188-SS-01   | 26.5   | <2.60              | 99.0        | 6.87    | 156 J          | 4.03     | <2.16   | 7.68         | 2.73            | <1.09   | <1.12   | 0.14       | 38  | <20          | <20             | <20          | <20          |
| 189-SS-01   | 41.9   | <10.7              | 94.0        | <8.38   | 198 J          | <6.87    | <8.89   | 8.55         | <3.44           | <3.30   | <2.00   | 0.51       | <20   | 610          | <20             | <20          | <20          |
| 189-SS-02   | 690  | <87.7              | 33,900 J,E  | 1170    | 31,800 J,E     | 1040     | <47.6   | 931          | 169             | <11.5   | 6.57    | 4.71       | <100  | <100         | 1400            | <100         | <100         |
| UCL <sup>2</sup>  | 1,164,970  | 18,126             | 4,475,566   | 362,353 | 7,706,713      | 240,452  | 13,793  | 654,961      | 218,436         | 130     | 128,797 | 6070       | NA  | NA           | 166,531         | 2460         | 86,419       |
| EPC <sup>3</sup>  | 1,200,000  | 18,000             | 4,500,000   | 360,000 | 7,700,000      | 240,000  | 14,000  | 650,000      | 220,000         | 130     | 130,000 | 6100       | 38  | 610          | 170,000         | 2500         | 86,000       |
| Outdoor Commercial/<br>Industrial Worker<br>Cancer-Based RBSL <sup>4</sup>                          | 81,000   | 27,000             | 270,000     | 270,000 | 270,000        | 270,000  | 81      | 270,000      | 270,000         | 270     | 270,000 | 8.1        | 530   | 530          | 530             | 530          | 530          |
| Predicted Lifetime<br>Excess Cancer Risk -<br>Outdoor Commercial/<br>Industrial Worker <sup>5</sup> | 1.5E-05  | 6.7E-07            | 1.7E-05     | 1.3E-06 | 2.9E-05        | 8.9E-07  | 1.7E-04 | 2.4E-06      | 8.1E-07         | 4.8E-07 | 4.8E-07 | 7.5E-04    | 7.2E-08   | 1.2E-06      | 3.2E-04         | 4.7E-06      | 1.6E-04      |
|   |  |                    |             |         |                |          |         |              | Cumulative Risk |         | 2E-04   | 8E-04      |   |              | Cumulative Risk |              | 5E-04        |

Notes:  
1. < = not detected at or above the reporting limit shown.  
2. Upper confidence limit (UCL) concentration of the mean, calculated using U.S. EPA's ProUCL product (U.S. EPA, 2010d). ProUCL output provided in Attachment B-2 of Appendix B.  
3. Exposure point concentration selected as the lower of the maximum detected concentration and the UCL concentration of the mean (rounded to two significant figures).  
4. Cancer-based risk-based screening levels (RBSLs) for outdoor commercial/industrial workers provided in Table 1.  
5. Predicted lifetime excess cancer risks estimated by dividing each EPC by the cancer-based RBSL, and then multiplying the risk ratio by the target risk level of the RBSL (i.e., 1x10<sup>-6</sup>).

Abbreviations:  
E = concentration detected is greater than the upper calibration limit  
EPC = exposure point concentration  
J = estimated value  
NA = not applicable. UCL concentration not calculated for Aroclor 1016 (only one detected concentration).  
UCL = Upper Confidence Limit

TABLE 24

**SITE-SPECIFIC REMEDIATION GOALS**  
**PCBs IN SOIL AND CONCRETE, AND METALS AND TPH IN SOIL**  
Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Compound   | Remediation Goal<br>(milligrams per<br>kilogram; mg/kg) | Explanation   |
|--|---|---|
| <b>PCBs<sup>1</sup> in Soil</b>  |   |   |
| Aroclor-1254   | 2.0   | Noncarcinogenic RBSL <sup>2</sup> for construction workers. Also protective of commercial/industrial worker exposure.   |
| Total Aroclors<br><i>For soil that may be left exposed at the surface (0 to 5 feet bgs)</i>  | 3.5   | Based on the regression analysis for dioxin-like PCB congeners versus total Aroclors in combined soil and concrete (Appendix E), the total Aroclor concentration that would result in a maximum dioxin TEQ concentration of 81 picograms/gram (pg/g). <sup>3</sup> Protective of cumulative commercial/industrial worker exposure, and cumulative construction worker exposure, to PCBs.  |
| Total Aroclors<br><i>For subsurface soil (5 to 15 feet bgs) that only construction workers may come into contact with during excavation, grading, etc. (and that would remain at 5 to 15 feet bgs)</i> | 23  | Based on the regression analysis for dioxin-like PCB congeners versus total Aroclors in combined soil and concrete (Appendix E), the total Aroclor concentration that would result in a maximum dioxin TEQ concentration of 530 pg/g. <sup>4</sup> Protective of cumulative construction worker exposure to PCBs.   |
| <b>PCBs in Concrete</b>  |   |   |
| Total Aroclors   | 3.5   | Based on the regression analysis for dioxin-like PCB congeners versus total Aroclors in combined soil and concrete (Appendix E), the total Aroclor concentration that would result in a maximum dioxin TEQ concentration of 81 pg/g. Also protective of cumulative construction worker exposure to PCBs. Applying this remediation goal ensures that waste criteria for concrete containing PCBs is also met [i.e., less than 50 mg/kg, as defined in 40 CFR Section 761.61(a)(4)(i)(A)]. |
| <b>Metals in Soil</b>  |   |   |
| Arsenic  | 10  | Site-Specific Background Concentration in Soil, established as described in Appendix B.   |
| <b>TPH<sup>5</sup> in Soil</b>   |   |   |
| c5-c10 hydrocarbons, c6-c10 hydrocarbons, c7-c12 hydrocarbons, and Stoddard solvent  | 500   | Screening Level for the Protection of Groundwater for TPH gasoline range (c4-c12) from the Los Angeles RWQCB Guidebook. <sup>6</sup>  |
| c10-c20 hydrocarbons and c10-c28 hydrocarbons  | 1000  | Screening Level for the Protection of Groundwater for TPH diesel range (c13-c22) from the Los Angeles RWQCB Guidebook. <sup>6</sup>   |
| c21-c28 hydrocarbons   | 10,000  | Screening Level for the Protection of Groundwater for TPH as residual fuel (c23-c32) from the Los Angeles RWQCB Guidebook. <sup>6</sup>   |

**Notes:**

1. PCBs = Polychlorinated Biphenyls.
2. RBSL = Risk-Based Screening Level. Developed based on the methodology described in Appendix C, RBSLs were used to conduct the screening-level human health risk assessment (Section 4.0).
3. Based on the carcinogenic RBSL for dioxin-like PCB congeners for outdoor commercial/industrial workers (8.1 pg/g TEQ), adjusted to a target cancer risk of  $10^{-5}$ .
4. Based on the carcinogenic RBSL for dioxin-like PCB congeners for construction workers (53 pg/g TEQ), adjusted to a target cancer risk of  $10^{-5}$ .
5. TPH = Total Petroleum Hydrocarbons
6. Los Angeles RWQCB Interim Site Assessment and Cleanup Guidebook (RWQCB Guidebook, May 1996, updated May 2004), for petroleum hydrocarbons and aromatic hydrocarbons (benzene, toluene, ethylbenzene, and total xylenes [BTX] compounds) in soil. The selected screening levels were taken from Table 4-1 assuming distance above groundwater is 20-150 feet.

**TABLE 25**

**SITE-SPECIFIC REMEDIATION GOALS<sup>1</sup>**

**VOCs IN SOIL**

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Depth<br>(Feet) | Concentration in micrograms per kilogram (µg/kg) |                   |         |         |              |         |                    |
|-----------------|--|-------------------|---------|---------|--------------|---------|--------------------|
|                 | Trichloroethene                                  | Tetrachloroethene | Benzene | Toluene | Ethylbenzene | Xylenes | 1,2-Dichloroethane |
| 0               | 152  | 764               | 15      | 9058    | 15,349       | 97,239  | 1.8                |
| 10              | 145  | 732               | 15      | 8670    | 14,690       | 93,069  | 1.7                |
| 20              | 138  | 694               | 14      | 8227    | 13,940       | 88,314  | 1.6                |
| 30              | 130  | 655               | 13      | 7769    | 13,164       | 83,398  | 1.5                |
| 40              | 122  | 615               | 12      | 7292    | 12,356       | 78,278  | 1.4                |
| 50              | 114  | 572               | 11      | 6777    | 11,484       | 72,756  | 1.3                |
| 60              | 80   | 404               | 8       | 4790    | 8116         | 51,415  | 0.9                |
| 70              | 60   | 301               | 6       | 3565    | 6040         | 38,267  | 0.7                |
| 80              | 52   | 260               | 5       | 3081    | 5220         | 33,071  | 0.6                |
| 90              | 36   | 183               | 4       | 2164    | 3667         | 23,230  | 0.5                |
| 100             | 27   | 138               | 3       | 1634    | 2768         | 17,538  | 0.5                |
| 110             | 12   | 59                | 1       | 702     | 1190         | 7536    | 0.5                |
| 120             | 9  | 44                | 1       | 530     | 900          | 5694    | 0.5                |
| 130             | 5  | 19                | 1       | 229     | 391          | 2466    | 0.5                |
| 140             | 5  | 10                | 1       | 150     | 300          | 1750    | 0.5                |
| 149             | 5  | 5                 | 1       | 150     | 300          | 1750    | 0.5                |

Note:

1. Calculations based on Appendix A, "Attenuation Factor Method For VOCs" of "Remediation Guidance For Petroleum and VOC Impacted Sites" in Interim Site Assessment & Cleanup Guidebook published by the California Regional Water Quality Control Board, Los Angeles Region.

**TABLE 26**  
**SCREENING OF SOIL TECHNOLOGIES<sup>1,2</sup>**  
Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Technology Type  | Description   | Remediation Scenario                                  | Effectiveness <sup>1</sup>   | Implementability <sup>1</sup>  | Cost <sup>1</sup>   | Screening Comments  |
|--|---|---|--|--|---|---|
| <b>NO ACTION</b>   |   |   |  |  |   |   |
| No Action  | No further remedial action would take place at the Site. Retained for comparative purposes only.  | All Shallow and Deep COC <sup>3</sup> -impacted soils | Poor. Does not meet RAOs <sup>4</sup> . Does not reduce mobility, toxicity, or volume of known wastes.                                     | Good   | Low. There are no costs associated with this alternative.                   | Retained as required by NCP <sup>5</sup> [40 CFR <sup>6</sup> 300.430 (e)(6)].  |
| <b>INSTITUTIONAL CONTROLS</b>  |   |   |  |  |   |   |
| Institutional controls<br>Examples include:<br>- Deed covenants<br>- Land use covenants<br>- Groundwater use restriction<br>- Zoning | Institutional controls are legal and administrative controls to prevent or control exposure to site occupants if residual contaminants remain on-site. These typically run with the land for perpetuity or as long as residual contamination exists.  | All Shallow and Deep COC-impacted soils               | Moderate   | Moderate   | Low   | Not retained. Institutional Controls would most likely include either deed or land use covenants, and possibly long-term groundwater monitoring. Property owner input is necessary to make determinations regarding future Site use. Evaluation of groundwater, except for consideration of applying a monitored natural attenuation approach for VOCs, <sup>7</sup> is not included in this FS. <sup>8</sup> |
| <b>CONTAINMENT</b>   |   |   |  |  |   |   |
| Capping  | Creates a direct contact or migration barrier using a combination of soil/clay/concrete/asphalt/geotextile liners to prevent direct contact with impacted soil or leaching to groundwater by infiltration. May also involve sub-slab venting beneath building foundations. Additional grading to ensure uniform surface for installation may be necessary. Both short-term construction and long-term quality assurance monitoring programs would be necessary. Could require future repairs or modifications to site redevelopment structures if cap was breached.           | All Shallow and Deep COC-impacted soils               | Good   | Moderate. Does meet the RAOs for the site. Does not reduce toxicity or volume through treatment of COCs. | Moderate  | Retained as physical barrier placed at depth for deeper PCB-impacted soil (depths greater than 15 feet). Future site use has not been determined, but will be commercial/industrial due to City of Vernon zoning requirements. Any potential future surface capping requirements would be met by new Site construction of slabs and pavements.  |
| Vapor Barrier  | Creates a vapor migration barrier using a combination of low permeability materials including synthetic liners to protect from volatile vapor intrusion into buildings or other structures. May also involve passive or active sub-slab venting beneath building foundations. Both short-term construction and long-term quality assurance monitoring programs would be necessary. Requires additional site grading to ensure uniform application. Can be easily breached during any future site redevelopment. Not effective on inorganic or non-volatile organic compounds. | PCB <sup>9</sup> -impacted soils                      | Poor. Does not meet RAOs. Does not reduce mobility, toxicity, or volume through treatment. Does not reduce the magnitude of residual risk. | Moderate   | Moderate. Capitol and annual operations and maintenance costs are required. | Not retained due to low-volatility of PCBs.   |
|  |   | VOC-impacted soils                                    | Good   | Moderate   | Moderate. Capitol and annual operations and maintenance costs are required. | Not retained for shallow- and deep-impacted soils. Any potential future vapor barrier requirements would be dictated by site reuse. Vapor barrier requirement may be negated by operation of an SVE <sup>10</sup> system.   |
|  |   | Metals-impacted soils                                 | N/A <sup>11</sup>  | N/A  | N/A   | Not applicable due to non-volatility of metals.   |
|  |   | Stoddard solvent-impacted soils                       | Good   | Moderate   | Moderate. Capitol and annual operations and maintenance costs are required. | Not retained for shallow- and deep-impacted soils. Any potential future vapor barrier requirements would be dictated by site reuse. Vapor barrier requirement may be negated by operation of an SVE system.   |



TABLE 26

SCREENING OF SOIL TECHNOLOGIES<sup>1,2</sup>  
Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Technology Type                           | Description   | Remediation Scenario                    | Effectiveness <sup>1</sup>   | Implementability <sup>1</sup>   | Cost <sup>1</sup> | Screening Comments   |
|---|---|---|--|---|-------------------|--|
| EX SITU TREATMENT                         |   |   |  |   |                   |  |
| Excavation and Removal                    | Excavation of impacted soils followed by treatment or disposal; excavated areas restored with clean backfill. May require additional sloping of side walls. Usually requires shoring at depths greater than 10 feet bgs. Excavation depth limited to size of excavator. Deeper excavations may require engineering and special equipment.   | All Shallow and Deep COC-impacted soils | Good. Would meet RAOs for Site.  | Moderate  | Moderate          | Retained. Excavation is a presumptive remedy for COC-impacted soil.  |
| Onsite Low Temperature Thermal Desorption | Excavated soil is heated to thermally desorb COCs, which are then treated in the vapor phase. Treated soil can either be used as site backfill or disposed/recycled offsite. Not effective for inorganic compounds. Thermal desorption unit operation requires approximately 1/2 acre of available space for operation, excluding stockpile areas. Requires fuel source (propane or natural gas), installation of electrical power or use of portable electrical generators. Requires AQMD <sup>12</sup> permit and fees to operate, and additional compliance monitoring costs. Excavation, stockpiling, and loading of COC-impacted soil necessary to feed unit. Temperatures typically not high enough to desorb and combust PCBs. | PCB-impacted soils                      | Poor. Temperatures not high enough to volatilize PCBs. Does not meet RAOs for the site. Does not reduce the toxicity, mobility, or volume through treatment. | Poor. Significant regulatory permitting issues and off-gas collection and treatment issues associated with thermal destruction of PCBs. | Moderate          | Not retained.  |
|   |   | VOC-impacted soils                      | Moderate   | Moderate  | Moderate          | Not retained for deeper VOC-impacted soils due to high relative costs when compared to in situ SVE. Also, not retained due to high permitting and operational costs.                     |
|   |   | Metals-impacted soils                   | N/A  | N/A   | N/A               | Not applicable for metals-impacted soil.   |
|   |   | Stoddard solvent-impacted soils         | Good   | Good  | Moderate          | Not retained for deeper Stoddard solvent-impacted soils due to high relative costs when compared to in situ bioventing. Also, not retained due to high permitting and operational costs. |

**TABLE 26**  
**SCREENING OF SOIL TECHNOLOGIES<sup>1,2</sup>**  
Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Technology Type                       | Description  | Remediation Scenario            | Effectiveness <sup>1</sup>  | Implementability <sup>1</sup>  | Cost <sup>1</sup>   | Screening Comments  |
|---------------------------------------|--|---------------------------------|---|--|---|---|
| Incineration                          | Incineration uses controlled flame combustion to destroy COCs. Combustion of remaining VOCs and PCBs in secondary combustion chamber. Requires stringent off gas collection and treatment. High temperatures necessary to break down inorganic and non-volatile compounds. Incineration unit operational costs are high. Hazardous residual ash requires landfill disposal. Not feasible to perform on-site due to regulatory permitting requirements. Requires excavation and transportation to out-of-state facilities for incineration. | PCB-impacted soils              | Moderate  | Poor. Not technically feasible on-site based on regulatory approval challenges. Would require transportation of impacted material to out-of-state facility; implementation would occur off-site. | High. Expensive operations, maintenance and monitoring costs.   | Not retained due to high costs.   |
|                                       |  | VOC-impacted soils              | Moderate  | Poor. Not technically feasible on-site based on regulatory approval challenges. Would require transportation of impacted material to out-of-state facility; implementation would occur off-site. | High. Expensive operations, maintenance and monitoring costs. Relatively more expensive than SVE technology | Not retained due to high costs.   |
|                                       |  | Metals-impacted soils           | Poor. Does not meet RAOs for the site.  | Poor. Not technically feasible on-site based on regulatory approval challenges. Would require transportation of impacted material to out-of-state facility; implementation would occur off-site. | High. Expensive operations, maintenance and monitoring costs.   | Not retained due to high costs.   |
|                                       |  | Stoddard solvent-impacted soils | Moderate  | Poor. Not technically feasible on-site based on regulatory approval challenges. Would require transportation of impacted material to out-of-state facility; implementation would occur off-site. | High. Expensive operations, maintenance and monitoring costs. Relatively more expensive than SVE technology | Not retained due to high costs.   |
| Onsite Landfarming/<br>Bioremediation | Soil is spread in shallow lifts (6-inch to 1-foot thick) and treated by supplying air, moisture and nutrients needed to enhance bioremediation of COCs. Not effective on metals. Requires available space to thinspread soil. May require bottom liner, fugitive dust and emission controls, and run-on and run-off stormwater controls. Requires operations, maintenance, and monitoring.   | PCB-impacted soils              | Poor. Not a reliable or proven technology for PCBs. Does not meet RAOs for the site. Does not reduce the mobility, toxicity, or volume through treatment. | Moderate. Requires fugitive dust and emission controls, potential AQMD permitting requirements, and stormwater controls.   | Moderate  | Not retained; PCBs degrade very slowly aerobically and may require specially formulated admixtures to enhance degradation. Also not retained due to additional costs associated with necessary Site controls. |
|                                       |  | VOC-impacted soils              | Moderate  | Moderate. Requires fugitive dust and emission controls, potential AQMD permitting requirements, and stormwater controls.   | Moderate  | Not retained due to additional costs associated with necessary Site controls.   |
|                                       |  | Metals-impacted soils           | N/A   | N/A  | N/A   | Not applicable; metals not biodegradable.   |
|                                       |  | Stoddard Solvent-impacted soils | Moderate  | Moderate. Requires fugitive dust and emission controls, potential AQMD permitting requirements, and stormwater controls.   | Moderate  | Not retained due to additional costs associated with necessary Site controls.   |

**TABLE 26**  
**SCREENING OF SOIL TECHNOLOGIES<sup>1,2</sup>**  
Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Technology Type  | Description  | Remediation Scenario                    | Effectiveness <sup>1</sup>  | Implementability <sup>1</sup>  | Cost <sup>1</sup> | Screening Comments   |
|--|--|---|---|--|-------------------|--|
| Offsite Treatment/Disposal<br>- Landfill Disposal<br>- Thermal Desorption<br>- Stabilization | Excavated soil is loaded into trucks or containers for offsite transport for subsequent treatment or disposal. Offsite treatment/disposal includes thermal desorption, stabilization, and/or landfill disposal.  | All Shallow and Deep COC-impacted soils | Good. Does meet RAOs for Site. One of the more common remedial technologies that has previously been broadly implemented.   | Moderate. Would require off-site shipment of soil for landfill disposal.   | Moderate          | Retained. Landfill disposal is a commonly used technology for COC-impacted soils.  |
| <b>IN SITU TREATMENT</b>   |  |   |   |  |                   |  |
| Bioremediation   | Intrinsic or enhanced bioremediation includes degradation of organic contaminants by naturally occurring microbes in the subsurface; other attenuation processes such as volatilization also occur. Enhanced bioremediation may include the addition of oxygen, biological agents, or nutrients to assist in degrading contaminants in soil. Requires subsurface injection or delivery gallery, and maintenance and monitoring. Requires a well characterized site; implementation requires long-term operations and monitoring. May require multiple applications of nutrients over a long term period necessary for complete remediation of COC-impacted soils. The use of SVE technologies on soils amenable to biodegradation is referred to as "bioventing." Bioventing is an aerobic remediation technology that enhances and accelerates the natural biodegradation process by providing oxygen as a source of electron acceptors to naturally-occurring microorganisms. These microorganisms degrade the fuel hydrocarbon contaminants by using them as a carbon source for cell production, generating carbon dioxide in the process. | PCB-impacted soils                      | Poor. Not an effectively demonstrated technology for PCBs. Does not meet RAOs for the site. Does not reduce the mobility, toxicity, or volume through treatment.      | Poor. Not a broadly implemented technology for PCBs.   | Moderate          | Not retained; PCBs degrade very slowly and may require specially formulated admixtures to enhance degradation. Also not retained due to nutrient delivery constraints, high maintenance and monitoring costs, and need for multiple applications over a long term.                           |
|  |  | VOC-impacted soils                      | Moderate. Not as effective as SVE for VOC constituents. Effectiveness limited to success of nutrient delivery system. Requires long-term maintenance and monitoring.  | Moderate   | Moderate          | Not retained due to nutrient delivery constraints, high maintenance and monitoring costs, and need for multiple applications over a long term.   |
|  |  | Metals-impacted soils                   | N/A   | N/A  | N/A               | Not applicable. Metals are not biodegradable.  |
|  |  | Stoddard solvent-impacted soils         | Good. Bioventing has been demonstrated at over 145 US Air Force sites with regulatory acceptance achieved in 38 states (including California) and all 10 EPA regions. | Good. Technology is related to the SVE process although in bioventing oxygen is most commonly supplied through low flow direct injection of atmospheric air into subsurface impacted soil zones. Previous treatability testing performed by Alcoa concluded that environmental conditions (for pH, naturally occurring nutrients, indigenous microbial populations and soil moisture) existed to depths of 45 feet bgs and would be supportive of in situ soil biodegradation. | Low to Moderate   | Bioventing is retained for shallow and deep Stoddard solvent-impacted soils. The US Air Force Center for Environmental Excellence concluded bioventing is a Presumptive Remedy to be applied to remediate fuel-related hydrocarbon contaminated soils at Air Force installations nationwide. |

**TABLE 26**  
**SCREENING OF SOIL TECHNOLOGIES<sup>1,2</sup>**  
Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Technology Type  | Description  | Remediation Scenario            | Effectiveness <sup>1</sup>  | Implementability <sup>1</sup> | Cost <sup>1</sup> | Screening Comments  |
|--|--|---------------------------------|---|-------------------------------|-------------------|---|
| Soil Vapor Extraction                                      | Volatile vapors removed from soil with slotted piping and a vacuum blower; extracted vapors treated aboveground with activated carbon or thermal oxidizer. This technology is usually implemented to remove VOCs in shallow or deep soils and is effective in moderate to highly permeable soils. Requires the installation of a soil vapor extraction well network, electrical power, AQMD <sup>12</sup> permit, and operations and maintenance. Not effective on inorganic or non-volatile compounds. Commonly implemented in moderate to large areas of impacted soils. | PCB-impacted soils              | Poor. Not an effective technology for PCB-impacted soils. Does not meet RAOs for the site. Does not reduce the mobility, toxicity, or volume through treatment. | Moderate                      | Moderate          | Not retained due to the non-volatility of PCBs.   |
|  |  | VOC-impacted soils              | Good  | Good                          | Moderate          | Retained for shallow and deep impacted soils. SVE is a presumptive remedy for VOC-impacted soils.   |
|  |  | Metals-impacted soils           | N/A   | N/A                           | N/A               | Not applicable due to non-volatility of metals.   |
|  |  | Stoddard solvent-impacted soils | Moderate  | Good                          | Moderate          | Retained for shallow and deep Stoddard solvent-impacted soils as an effective measure to remove the volatile constituents within Stoddard solvent estimated to comprise approximately 15 percent of the total mass. SVE can be easily converted to bioventing in the later stages of in situ remediation. |
| In situ Thermal Desorption<br>(Thermal conduction heating) | Heating subsurface soil using thermal wells via resistive heating elements with associated vapor extraction system to remove volatilized contaminants. Soil is heated by thermal conduction, and no current flows through soil. Extracted vapors are treated aboveground with activated carbon or a thermal oxidizer. Demonstrated high costs associated with installation and operation of the thermal heating elements. Requires AQMD permit to operate and long-term operations, maintenance, and permit compliance monitoring.   | PCB-impacted soils              | Poor. Does not meet RAOs for the site. Does not reduce the mobility, toxicity, or volume through treatment.   | Moderate                      | High              | Not retained due to low volatility of PCBs and high costs of implementation and operation of the system.  |
|  |  | VOC-impacted soils              | Moderate  | Moderate                      | High              | Not retained due to high costs of implementation and operation of the system relative to SVE technologies.  |
|  |  | Metals-impacted soils           | N/A   | N/A                           | N/A               | Not applicable due to non-volatility of metals.   |
|  |  | Stoddard solvent-impacted soils | Moderate  | Moderate                      | High              | Not retained due to high costs of implementation and operation of the system relative to bioventing and SVE technologies.   |

TABLE 26

SCREENING OF SOIL TECHNOLOGIES<sup>1,2</sup>  
Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Technology Type | Description   | Remediation Scenario            | Effectiveness <sup>1</sup>   | Implementability <sup>1</sup>                   | Cost <sup>1</sup> | Screening Comments  |
|-----------------|---|---------------------------------|--|---|-------------------|---|
| Stabilization   | In situ stabilization involves mixing contaminated soils with inorganic binders such as cement or pozzolans to bind or encapsulate soils. Effectiveness diminishes with higher concentration oily wastes. Requires implementation and mobilization of a stabilization material delivery unit. On-site pilot tests are necessary to estimate delivery quantity of stabilization material. Not effective on volatile compounds. | PCB-impacted soils              | Good. Previously demonstrated effective on sites with lower concentrations of PCBs in soil.          | Moderate. Would require bench scale mix design. | Moderate          | Retained  |
|                 |   | VOC-impacted soils              | Poor. Will require collection and treatment of VOC vapors generated during stabilization activities. | Moderate  | Moderate          | Not retained; poor effectiveness on VOCs. High volatility compounds would generate excessive odors during implementation. |
|                 |   | Metals-impacted soils           | Good. Stabilization is a commonly applied technology for metals-impacted soils.                      | Moderate  | Moderate          | Retained  |
|                 |   | Stoddard solvent-impacted soils | Good.  | Moderate. Would require bench scale mix design. | Moderate          | Retained  |

- Notes:**
- 1. Definitions of Criteria:
    - Effectiveness is ability of the remedial technology to achieve remedial action objectives;
    - Implementability is a measure of the technical and administrative feasibility of constructing, operating and maintaining a remedial alternative; and,
    - Cost refers to a relative cost compared with other technologies in same technology type. Costs will be refined later in the FS process.
  - 2. Table uses a relative rating scheme: Good, Moderate, Poor for effectiveness and implementability criteria; High, Moderate, and Low for cost criteria.
  - 3. COC = Chemical of Concern.
  - 4. RAOs = Remedial Action Objectives.
  - 5. NCP = National Contingency Plan.
  - 6. CFR = Code of Federal Regulations.
  - 7. VOC = Volatile Organic Compounds.
  - 8. FS = Feasibility Study.
  - 9. PCB = Polychlorinated Biphenyls.
  - 10. SVE = Soil Vapor Extraction.
  - 11. N/A = Not Applicable.
  - 12. AQMD = Air Quality Management District.

TABLE 27

SCREENING OF PCB-IMPACTED CONCRETE TECHNOLOGIES<sup>1,2</sup>

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Technology Type   | Description  | Remediation Scenario                | Effectiveness <sup>1</sup>  | Implementability <sup>1</sup>  | Cost <sup>1</sup>   | Screening Comments  |
|---|--|-------------------------------------|---|--|---|---|
| <b>NO ACTION</b>  |  |                                     |   |  |   |   |
| No Action   | No further remedial action would take place at the site. Retained for comparative purposes only.   | PCB <sup>3</sup> -impacted concrete | Poor. Does not meet RAOs. <sup>4</sup> Does not reduce mobility, toxicity, or volume of known wastes.   | Good   | Low. There are no costs associated with this alternative. | Retained as required by NCP <sup>5</sup> [40 CFR <sup>6</sup> 300.430 (e)(6)].  |
| <b>INSTITUTIONAL CONTROLS</b>   |  |                                     |   |  |   |   |
| Institutional controls<br>Examples include:<br>- Deed covenants<br>- Land use covenants<br>- Zoning | Institutional controls are legal and administrative controls to prevent or control exposure to site occupants if residual COCs <sup>7</sup> remain on-site. These typically run with the land for perpetuity or as long as residual contamination exists.  | PCB-impacted concrete               | Moderate  | Moderate   | Low   | Not retained. Institutional Controls would most likely include either deed or land use covenants. Property owner input is necessary to make determinations regarding future Site use. |
| <b>EX SITU TREATMENT</b>  |  |                                     |   |  |   |   |
| Demolition and Disposal   | Demolition of PCB-impacted concrete followed by offsite disposal. Demolition involves the use of heavy equipment. Concrete is sawcut and removed or demolished using a hydraulic breaker. Requires dust and noise controls. Offsite disposal requires sizing. Onsite disposal would require U.S. EPA approval. | PCB-impacted concrete               | Good. Would meet RAOs.  | Good   | Moderate  | Retained. On-site disposal would require deed or land use covenant.   |
| <b>IN SITU TREATMENT</b>  |  |                                     |   |  |   |   |
| Scarification   | Impacted concrete is removed in thin layers using a grinder. Creates a fine dusty material. Requires use of heavy equipment with grinder attachments. Dust and noise controls are necessary to protect workplace. Impacted concrete must be well defined in are  | PCB-impacted concrete               | Poor. Not cost effective on multi-layered surfaces that would require demolition and removal of overlying concrete after scarification of surface, to provide access to lower impacted layers for additional scarification. | Moderate. Impacted concrete dust will require collection and disposal. | Moderate  | Not retained due to lack of effectiveness and dust collection issues.   |

TABLE 27

**SCREENING OF PCB-IMPACTED CONCRETE TECHNOLOGIES<sup>1,2</sup>**  
 Former Pechiney Cast Plate, Inc. Facility  
 Vernon, California

| Technology Type                    | Description   | Remediation Scenario  | Effectiveness <sup>1</sup>   | Implementability <sup>1</sup>  | Cost <sup>1</sup>  | Screening Comments   |
|------------------------------------|---|-----------------------|--|--|--|--|
| Encapsulation                      | Encapsulation or sealing of impacted concrete slab areas involves physically microencapsulating wastes by sealing them with an applied compound. Encapsulation is typically performed with polymers, resins or other proprietary binding and sealing compounds. | PCB-impacted concrete | Poor. Surface encapsulation effectiveness is limited to the adhesion between coating and bound wastes. Long-term integrity has not been effectively demonstrated on other sites. Selected bonding agent would need to be resistant to ultraviolet radiation. | Moderate. Requires the impacted surface to be free of dust or other materials that might affect bonding capability of sealant. | High   | Not retained. Encapsulation would require the slab areas to be left in place. This would not allow demolition of existing below grade foundations and footings that are being removed as a component of the Site cleanup. Encapsulation would likely require TSCA <sup>8</sup> -related deed covenants or land use restrictions. Property owner input is necessary to make determinations regarding future Site use. |
| Steam Cleaning or Pressure Washing | High pressure and/or hot water spray is applied to impacted concrete surfaces to remove contaminants. Not effective on multi-layered surfaces. Does not remove heavily-stained or oil impregnated impacts on porous concrete.                                   | PCB-impacted concrete | Poor. Existing surface slabs were steam cleaned during above grade demolition work associated with building and floor cleaning; subsequent concrete coring indicated PCB-impacts above screening criteria were still present at the surface.                 | Moderate. Requires collection and disposal of impacted washing rinsate.  | High. Not cost effective on multi-layered surfaces that would require demolition and removal of overlying concrete to provide access to lower impacted layers for additional steam cleaning. | Not retained due to lack of effectiveness.   |

Notes:

1. Definitions of Criteria:
  - Effectiveness is ability of the remedial technology to achieve remedial action objectives;
  - Implementability is a measure of the technical and administrative feasibility of constructing, operating and maintaining a remedial alternative; and,
  - Cost refers to a relative cost compared with other technologies in same technology type. Costs will be refined later in the FS process.
2. Table uses a relative rating scheme: Good, Moderate, Poor for effectiveness and implementability criteria; high, moderate, and low for cost criteria.
3. PCB = Polychlorinated Biphenyls.
4. RAOs = Remedial Action Objectives.
5. NCP = National Contingency Plan.
6. CFR = Code of Federal Regulations.
7. COC = Chemical of Concern
8. TSCA = Toxic Substances Control Act deed covenants [40 CFR 761.61(a)(8)].



TABLE 28

EVALUATION OF REMEDIAL ALTERNATIVES  
Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Remedial Alternative Description<br>[40 CFR 300.430 (d)(1)] <sup>1</sup>  | Overall Protection of Human Health and Environment<br>[40 CFR 300.430 (e)(9)(iii)(A)]   | Compliance with ARARs <sup>2</sup><br>[40 CFR 300.430 (e)(9)(iii)(B)] | Long-Term Effectiveness<br>[40 CFR 300.430 (e)(9)(iii)(C)]   | Reduction of Mobility, Toxicity, and Volume by Treatment<br>[40 CFR 300.430 (e)(9)(iii)(D)]                       | Short-Term Effectiveness<br>[40 CFR 300.430 (e)(9)(iii)(E)]  | Implementability<br>[40 CFR 300.430 (e)(9)(iii)(F)]   | State Support/Agency Acceptance<br>[40 CFR 300.430 (e)(9)(iii)(H)]   | Community Acceptance<br>[40 CFR 300.430 (e)(9)(iii)(I)] | Capital Cost<br>[40 CFR 300.430 (e)(9)(iii)(G)(1)] | O&M <sup>3</sup> Cost for 3 years<br>[40 CFR 300.430 (e)(9)(iii)(G)(2)] | Total Cost NPV <sup>4</sup> 3 years<br>[40 CFR 300.430 (e)(9)(iii)(G)(3)] |
|---|---|---|--|---|--|---|--|---|--|---|---|
| <b>Alternative 1: No Action [40 CFR 300.430 (e)(6)]</b>   |   |   |  |   |  |   |  |   | <b>\$0</b>   | <b>\$0</b>  | <b>\$0</b>  |
| No further action required.   | Would not meet RAOs <sup>5</sup> for the Site.  | No activities proposed that would trigger action-specific ARARs.      | RAOs not achieved.   | Limited reduction in mobility, toxicity, or volume.   | RAOs not achieved.   | No additional effort required.  | Not Acceptable.  | Not Acceptable.   |  |   |   |
| <b>Alternative 2: Excavation and Disposal of All COC<sup>6</sup>-Impacted Soil + Demolition and Disposal of PCB<sup>7</sup>-Impacted Concrete</b>   |   |   |  |   |  |   |  |   | <b>\$29,400,000</b>                                | <b>\$0</b>  | <b>\$29,400,000</b>   |
| 1) Soil Excavation and Off-Site Disposal.   | Would meet RAOs of mitigating shallow COC-impacted soils above the risk-based remediation goals summarized in Tables 24 and 25. Excavation poses no overall element of risk to human health or the environment. | Would comply with ARARs.  | Would prevent potential human exposure by eliminating pathways between future receptors and soil, soil vapor, and airborne dusts. Evaluated using CERCLA <sup>8</sup> guidelines (U.S. EPA, 1988, Section 6.2.3.3). <sup>9</sup> | Would reduce the volume of COCs in soil. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.4).     | Risk to receptors and the environment is low if appropriate PPE <sup>10</sup> is worn by workers and dust, noise and odor controls are implemented. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.5). | Technology is reliable and effective. Impacted areas would need to be well defined, but implementation is relatively straightforward using commercially available equipment. Shoring or other stability measures are required. Necessary permits must be obtained. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.6). | Will be evaluated after the FS has been reviewed by DTSC, and U.S. EPA issues its approval of the PCB-related actions. | Will be evaluated during public participation process.  |  |   |   |
| 2) Concrete Demolition and Disposal.  | Would meet RAOs to mitigate PCBs above the risk-based remediation goals established for future site use of concrete. These goals are summarized in Table 24.  | Would comply with ARARs.  | Would prevent potential human exposure by eliminating pathways between potential receptors and recycled concrete and airborne concrete dust. Evaluated using CERCLA guidelines (U.S. EPA, 1988, section 6.2.3.3).                | Would reduce the volume of PCBs in concrete. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.4). | Risk to receptors and the environment is low if appropriate PPE is worn by workers and dust, noise and odor controls are implemented. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.5).               | Impacted areas would need to be well defined, but implementation relatively straightforward using commercially available equipment. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.6).  | Will be evaluated after the FS has been reviewed by DTSC, and U.S. EPA issues its approval of the PCB-related actions. | Will be evaluated during public participation process.  |  |   |   |
| <b>Alternative 3: Excavation and Disposal of Shallow COC-Impacted Soil + Soil Vapor Extraction for Shallow and Deep VOC-Impacted Soil + SVE and Bioventing for Shallow and Deep Stoddard Solvent-Impacted Soil + Demolition and Disposal of PCB-Impacted Concrete</b> |   |   |  |   |  |   |  |   | <b>\$1,600,000</b>                                 | <b>\$2,200,000</b>  | <b>\$3,800,000</b>  |
| 1) Soil Excavation and Off-Site Disposal.   | Would meet RAOs of mitigating shallow COC-impacted soils above the risk-based remediation goals summarized in Tables 24 and 25. Excavation poses no overall element of risk to human health or the environment. | Would comply with ARARs.  | Would prevent potential human exposure by eliminating pathways between future receptors and soil, soil vapor, and airborne dusts. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.3).                           | Would reduce the volume of COCs in soil. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.4).     | Risk to receptors and the environment is low if appropriate PPE is worn by workers and dust, noise and odor controls are implemented. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.5).               | Technology is reliable and effective. Impacted areas would need to be well defined, but implementation relatively straightforward using commercially available equipment. Shoring or other stability measures are required. Necessary permits must be obtained. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.6).    | Will be evaluated after the FS has been reviewed by DTSC, and U.S. EPA issues its approval of the PCB-related actions. | Will be evaluated during public participation process.  |  |   |   |

TABLE 28

EVALUATION OF REMEDIAL ALTERNATIVES

Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Remedial Alternative Description<br>[40 CFR 300.430 (d)(1)] <sup>1</sup>   | Overall Protection of Human Health and Environment<br>[40 CFR 300.430 (e)(9)(iii)(A)]  | Compliance with ARARs <sup>2</sup><br>[40 CFR 300.430 (e)(9)(iii)(B)] | Long-Term Effectiveness<br>[40 CFR 300.430 (e)(9)(iii)(C)]   | Reduction of Mobility, Toxicity, and Volume by Treatment<br>[40 CFR 300.430 (e)(9)(iii)(D)]  | Short-Term Effectiveness<br>[40 CFR 300.430 (e)(9)(iii)(E)]  | Implementability<br>[40 CFR 300.430 (e)(9)(iii)(F)]  | State Support/Agency Acceptance<br>[40 CFR 300.430 (e)(9)(iii)(H)]   | Community Acceptance<br>[40 CFR 300.430 (e)(9)(iii)(I)] | Capital Cost<br>[40 CFR 300.430 (e)(9)(iii)(G)(1)] | O&M <sup>3</sup> Cost for 3 years<br>[40 CFR 300.430 (e)(9)(iii)(G)(2)] | Total Cost NPV <sup>4</sup> 3 years<br>[40 CFR 300.430 (e)(9)(iii)(G)(3)] |
|--|--|---|--|--|--|--|--|---|--|---|---|
| 2) Soil Vapor Extraction.  | Would meet RAOs of mitigating deeper soils impacted with COCs for protection of groundwater and poses no overall element of risk to human health or the environment.   | Would comply with ARARs.  | SVE is a presumptive remedy and can achieve site-specific remediation goals for VOC-impacted soils. Would prevent potential human exposure by eliminating pathways between future receptors and soil and soil vapors. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.3).               | Would reduce mobility of VOCs in subsurface, and reduce mass of VOCs and Stoddard Solvents in soil. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.4).   | Poses low risk to receptors and the environment if appropriate PPE is worn by workers and noise and odor controls are established during implementation. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.5).    | Implementation requires well defined impacted areas with an effective monitoring program of the SVE system. Technology is reliable and effective. Necessary permits must be obtained for operation. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.6). | Will be evaluated after the FS has been reviewed by DTSC.  | Will be evaluated during public participation process.  |  |   |   |
| 3) Bioventing.   | Would meet RAOs of mitigating deeper soils impacted with COCs for protection of groundwater and poses no overall element of risk to human health or the environment.   | Would comply with ARARs.  | Presumptive remedy that can achieve site-specific remediation goals for Stoddard Solvent-impacted soils. Bioventing would prevent potential human exposure by eliminating pathways between future receptors and soil and soil vapors. Evaluated using CERCLA guidelines (US EPA, 1988, section 6.2.3.3). | Would reduce mobility of Stoddard Solvents in subsurface, and reduce mass of Stoddard Solvents in soil. Evaluated using CERCLA guidelines (US EPA, 1988, section 6.2.3.4). | Poses very low risk to receptors and the environment if appropriate PPE is worn by workers and noise and odor controls are established during implementation. Evaluated using CERCLA guidelines (US EPA, 1988, section 6.2.3.5). | Implementation requires well defined impacted areas. Technology is reliable and effective with regulatory acceptance in 38 states (including California) and all 10 EPA regions. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.6).                    | Will be evaluated after the FS has been reviewed by DTSC.  | Will be evaluated during public participation process.  |  |   |   |
| 4) Concrete Demolition and Disposal.   | Would meet RAOs to mitigate PCBs above the risk-based remediation goals established for future site use of concrete. These goals are summarized in Table 24.   | Would comply with ARARs.  | Would prevent potential human exposure by eliminating pathways between potential receptors and recycled concrete and airborne concrete dust. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.3).  | Would reduce the volume of PCBs in concrete. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.4).  | Appropriate PPE would be worn by workers and dust, noise and odor controls would be established during implementation. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.5).                                      | Impacted areas would need to be well defined, but implementation relatively straightforward using commercially available equipment. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.6).   | Will be evaluated after the FS has been reviewed by DTSC, and U.S. EPA issues its approval of the PCB-related actions. | Will be evaluated during public participation process.  |  |   |   |
| <b>Alternative 4: In Situ Stabilization of Shallow PCB/Metals-Impacted Soil and Deep Stoddard Solvent-Impacted Soil + Soil Vapor Extraction for Shallow and Deep VOC-Impacted Soil + Demolition and Disposal PCB-Impacted Concrete</b> |  |   |  |  |  |  |  |   | <b>\$11,500,000</b>                                | <b>\$1,100,000</b>  | <b>\$12,600,000</b>   |
| 1) Soil Stabilization.   | Would not meet RAO of mitigating shallow COC-impacted soils above the risk-based remediation goals summarized in Table 15. Poses no overall element of risk to human health or the environment. Would meet RAO of mitigating soils impacted with COCs for protection of groundwater. | Would comply with ARARs.  | Would prevent potential human exposure by eliminating pathways between future receptors and soil, soil vapor, and airborne dusts. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.3).   | Would reduce the mobility and possibly toxicity of COCs in soil. No reduction in volume. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.4).              | Risk to receptors and the environment is low if appropriate PPE is worn by workers and dust, noise and odor controls are implemented. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.5).                       | Requires a bench-scale test and a well defined impacted area. Implementation relatively straightforward using large diameter auger drilling rig. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.6).  | Will be evaluated after the FS has been reviewed by DTSC, and U.S. EPA issues its approval of the PCB-related actions. | Will be evaluated during public participation process.  |  |   |   |

TABLE 28  
EVALUATION OF REMEDIAL ALTERNATIVES  
Former Pechiney Cast Plate, Inc. Facility  
Vernon, California

| Remedial Alternative Description<br>[40 CFR 300.430 (d)(1)] <sup>1</sup> | Overall Protection of Human Health and Environment<br>[40 CFR 300.430 (e)(9)(iii)(A)]  | Compliance with ARARs <sup>2</sup><br>[40 CFR 300.430 (e)(9)(iii)(B)] | Long-Term Effectiveness<br>[40 CFR 300.430 (e)(9)(iii)(C)]   | Reduction of Mobility, Toxicity, and Volume by Treatment<br>[40 CFR 300.430 (e)(9)(iii)(D)]  | Short-Term Effectiveness<br>[40 CFR 300.430 (e)(9)(iii)(E)]   | Implementability<br>[40 CFR 300.430 (e)(9)(iii)(F)]  | State Support/Agency Acceptance<br>[40 CFR 300.430 (e)(9)(iii)(H)]   | Community Acceptance<br>[40 CFR 300.430 (e)(9)(iii)(I)] | Capital Cost<br>[40 CFR 300.430 (e)(9)(iii)(G)(1)] | O&M <sup>3</sup> Cost for 3 years<br>[40 CFR 300.430 (e)(9)(iii)(G)(2)] | Total Cost NPV <sup>4</sup> 3 years<br>[40 CFR 300.430 (e)(9)(iii)(G)(3)] |
|--|--|---|--|--|---|--|--|---|--|---|---|
| 2) Soil Vapor Extraction.  | Would meet RAOs of mitigating deeper soils impacted with COCs for protection of groundwater and poses no overall element of risk to human health or the environment. | Would comply with ARARs.  | SVE is a presumptive remedy and can achieve site-specific remediation goals for VOC-impacted soils. Would prevent potential human exposure by eliminating pathways between future receptors and soil and soil vapors. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.3). | Would reduce mobility of VOCs in subsurface, and reduce mass of VOCs and Stoddard Solvents in soil. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.4). | Poses low risk to receptors and the environment if appropriate PPE is worn by workers and noise and odor controls are established during implementation. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.5). | Implementation requires well defined impacted areas with an effective monitoring program of the SVE system. Technology is reliable and effective. Necessary permits must be obtained for operation. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.6). | Will be evaluated after the FS has been reviewed by DTSC.  | Will be evaluated during public participation process.  |  |   |   |
| 3) Concrete Demolition and Disposal.                                     | Would meet RAOs to mitigate PCBs above the risk-based remediation goals established for future site use of concrete. These goals are summarized in Table 24.         | Would comply with ARARs.  | Would prevent potential human exposure by eliminating pathways between potential receptors and recycled concrete and airborne concrete dust. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.3).  | Would reduce the volume of PCBs in concrete. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.4).  | Appropriate PPE would be worn by workers and dust, noise and odor controls would be established during implementation. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.5).                                   | Impacted areas would need to be well defined, but implementation relatively straightforward using commercially available equipment. Evaluated using CERCLA guidelines (U.S. EPA, 1988, Section 6.2.3.6).   | Will be evaluated after the FS has been reviewed by DTSC, and U.S. EPA issues its approval of the PCB-related actions. | Will be evaluated during public participation process.  |  |   |   |

Notes:  
1. National Contingency Plan Code of Federal Regulations Guidance.  
2. Applicable or relevant and appropriate requirements (ARARs).  
3. O&M = Operations and Maintenance.  
4. NPV = Net Present Value.  
5. RAO = Remedial Action Objective.  
6. COC = Chemical of Concern.  
7. PCB = Polychlorinated Biphenyls.  
8. CERCLA = Comprehensive Environmental Response, Compensation and Liability Act.  
9. United States Environmental Protection Agency (U.S. EPA), Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, 1988.  
10. PPE = Personal Protective Equipment.  
11. H&EC = Health and Environmental Compliance.